Complete Course Grid and Syllabus

Course Grid for Diploma in Petroleum Engineering

Rajiv Gandhi Institute of Petroleum Technology

RGIPT Sivasagar Campus

Course: Diploma in Petroleum Engineering

Total Number of Credits: 340

SEMESTER I					
Course Code	**Subjects**	**L**	**T**	**P**	**Credits**
MA101	Mathematics-I	3	1	0	11
PY101	Physics-I	3	1	0	11
CY101	Chemistry-I	3	0	0	9
ME101	Engineering Mechanics	2	1	0	8
CS101	Fundamentals of Computer Engineering	2	0	2	8
ME102L	Engineering Drawing	0	0	3	3
PY101L	Physics Laboratory	0	0	2	2
TOTAL					**52**
HU101	Universal Human Values	1	1	0	5
L101	Communication Skills*	2	0	1	7
*For selective students with less proficiency in English					

SEMESTER II					
Course Code	**Subjects**	**L**	**T**	**P**	**Credits**
MA102	Mathematics-II	3	1	0	11
PY102	Physics-II	3	1	0	11
CY102	Chemistry-II	3	0	0	9
EE101	Fundamentals of Electrical and Electronics Engineering	3	1	0	11
CS102	Computer Programming	2	0	2	8
ME103L	Engineering Workshop Practices Laboratory	0	0	3	3
CY101L	Chemistry Laboratory	0	0	2	2
EE101L	Fundamentals of Electrical and Electronics Engineering Laboratory	0	0	2	2
TOTAL					57
HU102	Community Internship	1	1	0	5

SEMESTER III					
Course Code	**Subjects**	**L**	**T**	**P**	**Credits**
PE201	Basics of Geological Science	3	0	0	9
PE202	Reservoir Engineering-I	3	1	0	11
PE203	Production Engineering-I	3	0	0	9
PE204	Drilling Engineering-I	3	0	0	9
CE201	Unit Operations -I	3	1	0	11
ME206	Engineering Thermodynamics	3	0	0	9
CE201L	Unit Operations Laboratory-I	0	0	2	2
PE201L	Geology Laboratory	0	0	2	2
PE205	Group Discussion	0	0	2	2
TOTAL					64

SEMESTER IV					
Course Code	**Subjects**	**L**	**T**	**P**	**Credits**
PE206	Reservoir Engineering-II	3	1	0	11
PE207	Basics of Petroleum Refinery	3	0	0	9
PE208	Drilling Engineering-II	3	1	0	11
PE209	Production Engineering-II	3	0	0	9
PE210	Health, Safety and Environment Management	3	0	0	9
PE204L	Drilling Fluid and Cementation Laboratory	0	0	2	2
PE202L	Reservoir Engineering Laboratory	0	0	2	2
PE211	Seminar	0	0	2	2
TOTAL					**55**

SEMESTER V					
Course Code	**Subjects**	**L**	**T**	**P**	**Credits**
PE301	Workover and Well Stimulation	3	1	0	11
PE302	Petroleum Formation Evaluation	3	1	0	11
PE303	Offshore Oil and Gas Operations	3	0	0	9
HU301	Humanities	2	0	0	6
MT301	Engineering Economics	2	1	0	8
	Departmental Elective	3	0	0	9
	Open Elective	3	0	0	9
PE307L	Petroleum Product Testing Laboratory	0	0	2	2
TOTAL					**65**

SEMESTER VI					
Course Code	**Subjects**	**L**	**T**	**P**	**Credits**
PE308	Skill Development Certificate Course			x*	x*
PE309	Project			30-x	30-x
TOTAL					**30**

Subject Code	Departmental Elective/Open Elective
PE304	City Gas Distribution
PE305	Unconventional Oil and Gas Resources
PE306	Pipeline Transportation of Oil & Gas

Component distribution for diploma in Petroleum Engineering					
Category	**Program Components**	**Approved Range**		**Petroleum**	
		Min	**Max**	**Existing**	**Recommended (Revised)**
HU	Humanities and Social Science	12	24	16	16
IS	Institute Science Courses	50	80	66	66
IE	Institute Engineering Courses	40	70	68	59
EP	Engineering Drawing, Workshop	8	24	10	10
LM	Language and Management	8	20	15	15
DC	Departmental Core	125	160	131	126
DE	Departmental Elective	8	20	9	9
OE	Open Elective	8	20	9	9
DP	Project/ Industrial visit	20	50	20	30
	Total	**340**	**360**	**344**	**340**

Syllabus

Semester I

Mathematics-I

1.1 Course Number: MA101
1.2 Contact Hours:3-1-0   Credits:11
1.3 Semester-offered: 1st Year –Odd
1.4 Prerequisite: Class 10th level Mathematics
1.5 Syllabus Committee Members: Dept. of Mathematical Sciences, RGIPT

2. Objective:

This course is designed to give a comprehensive coverage at an introductory level to the subject of Trigonometry, Co-ordinate Geometry, Complex Numbers, Differential Calculus and Vector Algebra.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Trigonometry**	Concept of angle; Measurement of angle in degree, grades and radians and their conversions; Trigonometric ratios; Sum, difference formulae and their applications (Without proof); Product formula (Transformation of Product to Sum and Differences and vice versa); Trigonometric Ratios of multiple angles, sub-multiple angles (2A,3A, A/2); Graph of sinx, cosx, tanx, cosecx, secx and cotx., Basic concept of inverse trigonometric functions.	8
2	**Co-ordinate Geometry**	Equation of straight line in various standard form (Without Proof); Intersection of two straight lines Angle between two straight lines; Parallel lines and perpendicular lines; Perpendicular distance formula Sections of a cone: Circle, Parabola, Ellipse and Hyperbola; General equation of a circle and its characteristics; Definition of conics (Parabola, Ellipse, Hyperbola) their standard equations (without proof).	8
3	**Complex Numbers**	Definition of Complex numbers; Real and imaginary parts of a Complex number; Conjugate of a complex number; Modulus and amplitude of a complex number; Addition, Subtraction, Multiplication and Division of complex numbers, Polar and Cartesian form of a complex number and its conversion from one form to other, De-Movier's theorem and its application.	7
4	**Differential Calculus**	Definition of function; Concept of limits; Four standard limits $\lim_{x \to a}\dfrac{x^n - a^n}{x-a}, \lim_{x \to 0}\dfrac{\sin x}{x}, \lim_{x \to 0}\dfrac{a^x - 1}{x} \, and \lim_{x \to 0}(1+x)^{1/x}$, Differentiation of $x^n, \sin x, \cos x, e^x \, and \log_a x$ by the first principle rule of derivative, Differentiation of sum, product and quotient of functions; Differentiation of function of a function; Differentiation of trigonometric and inverse trigonometric functions; Logarithmic differentiation; Exponential functions.Definition & meaning of partial derivative. Evaluation of partial derivatives. Definition & examples of homogeneous	12

		functions. Euler's theorem (1st order) on Homogeneous functions for 2 variables (without proof). Problems.	
5	**Vector Algebra**	Definition, notation and rectangular resolution of a vector; Addition and subtraction of vectors; Scalar and vector products of 2 vectors; Simple problems related to work; moment and angular velocity.	6
		Total	**41**

4. Reading

4.1 Textbooks:

1. B.S. Grewal, Higher Engineering Mathematics, Khana Publishers, New Delhi, 40th Edition, 2007.
2. Mathematics Textbook for Class XI and XII (NCERT).
3. S. L. Loney, The Elements of Coordinate Geometry Part-1 Cartesian Coordinate.

4.2 Reference Books:

1. R. D. Sharma, Mathematics for Class 11and 12.
2. E. Kreyszig, Advanced Engineering Mathematics, Khanna Publisher.
3. Murray R. Spiegel, Robert E. Moyer, College Algebra, Tata McGraw Hill, New Delhi, 2nd Edition, 2000.
4. Frank Ayers, Elliot Mendelson, Calculus, McGraw Hill, New York, 4th Edition.

5. Outcome of the Course:

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

1) Solve problems involving angles, triangles, and periodic phenomena using trigonometric functions. Apply trigonometry in real-world situations, such as navigation, physics, and engineering
2) Understand the cartesian coordinate system and the relationship between points, lines, and curves. Represent geometric figures using equations and inequalities.
3) Understand the concept of a derivative as the rate of change and slope of a function.
4) Apply complex numbers in solving equations and expressing solutions.
5) Understand the geometric and algebraic properties of vectors.

Physics-I

1.1 Course Number: PY101
1.2Contact Hours: 3-1-0   Credits:11
1.3 Semester-offered: 1st Year - Odd
1.4 Prerequisite: Class 10th level Physics and Mathematics
1.5 Syllabus Committee Members: Dr. Shikha Dwivedi & Dr. Nimisha Raghuvanshi

2. Objective:

i) Physics is the mother of all engineering disciplines hence students must have a fundamental understanding of the topic in order to grasp their core engineering subjects more readily. As a result, while reviewing the curriculum, emphasis was placed on the concepts, laws, working equations, and basic notions of physics to assist students in studying the key courses.

ii) This will give a solid foundation for future self-development in order to cope with new advances. The study of physics encompasses a wide range of fascinating subjects, many of which have something to do with the materials and objects that surround us. It tries to provide a knowledge of this environment via both observation and behavior prediction of such items.

iii) The course material places a strong emphasis on the practical application of physical concepts and analysis in a variety of engineering and technological sectors.

iv) The course will assist diploma engineers in using fundamental ideas and principles to tackle complex engineering issues and comprehend various technology-based applications.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Units and Measurements**	Physical quantities: Fundamental and derived, Units and systems of units (FPS, CGS and SI units), Dimensions and dimensional formulae of physical quantities, Principle of homogeneity of dimensions, Dimensional equations and their applications (conversion from one system of units to other, checking of dimensional equations and derivation of simple equations), Limitations of dimensional analysis. Measurements: Need, Measuring instruments, Least count, Types of measurement (direct and indirect), Errors in measurements (systematic and random), Absolute error, Relative error, Error propagation, Error estimation and significant figures.	8
2	**Scalars and Vectors**	Scalar and Vector quantities: Examples, Representation of vectors, Types of vectors, Addition and Subtraction of Vectors, Triangle and Parallelogram law (Statement only), Scalar and Vector product, Resolution of a vector and its application to inclined plane. Kinematics equations in scalar and vector form with related numerical problems.	7
3	**Force and**	Force, Momentum, Statement and derivation of conservation of	8

	Motion	linear momentum, its applications such as recoil of gun, Rockets, Impulse and its applications. Circular motion, Angular displacement, Angular velocity, Angular acceleration, Frequency, Time period, Relation between linear and angular velocity, Linear acceleration and angular acceleration (related numerical), Centripetal and centrifugal forces with live examples, Moment of inertia and its physical significance, Definition of torque and angular momentum and their examples.	
4	**Work, Power and Energy**	Work: Concept and unit, Examples of zero work, Positive work and negative work. Friction: Concept, Types of friction, Laws of limiting friction, Coefficient of friction, Reducing friction and its engineering applications, Work done in moving an object on horizontal and inclined plane (for rough and smooth surfaces) and related applications. Energy and its unit, Kinetic energy, Gravitational potential energy with examples and derivations, Mechanical energy, Conservation of mechanical energy for freely falling bodies, Transformation of energy (examples). Power and its unit, Power and work relationship, Calculation of power (numerical problems).	7
5	**Properties of Matter**	Elasticity: Definition of stress and strain, Moduli of elasticity, Hooke's law, Significance of stress-strain curve. Pressure: Definition, Unit, Atmospheric pressure, Gauge pressure, Absolute pressure, Fortin's Barometer and its applications. Surface tension: Concept, Unit, Cohesive and adhesive forces, Angle of contact, Ascent Formula (No derivation), Applications of surface tension, Effect of temperature and impurity on surface tension. Viscosity and coefficient of viscosity, Terminal velocity, Stokes' law and effect of temperature on viscosity, Application in hydraulic systems. Hydrodynamics: Fluid motion, Stream line and turbulent flow, Reynold's number, Equation of continuity, Bernoulli's Theorem (only formula and numerical) and its applications.	12
	Total		**42**

4. Readings

4.1 Textbooks:

1. Textbook of Physics for Class XI (Part-1, Part-2); N.C.E.R.T., Delhi.

4.2 **Reference Books:**

1. Applied Physics, Vol. I and Vol. II, TTTI Publications, Tata McGraw Hill, Delhi.
2. Concepts in Physics by H. C. Verma, Vol. I&II, Bharti Bhawan Ltd., New Delhi.
3. Engineering Physics by P. V. Naik, Pearson Education Pvt. Ltd, New Delhi.
4. Engineering Physics by D. K. Bhattacharya & Poonam Tandan; Oxford University Press, New Delhi.
5. Comprehensive Practical Physics, Vol, I & II, J. N. Jaiswal, Laxmi Publications (P) Ltd., New Delhi.
6. Practical Physics by C. L. Arora, S. Chand Publication.

5. Outcomes of the Course:

After undergoing this subject, the student will be able to:

1) Explain and identify physical quantities along with their units and make measurements with accuracy by minimizing different types of errors.
2) Understand the scalar and vector quantities and use this knowledge in solving relevant real-life problems.
3) Describe the types of friction, its coefficients and methods to reduce or increase friction between different surfaces.
4) Analyze different types of motion, acting forces along the motion and conservation of momentum principle to describe rocket propulsion, recoil of gun etc.
5) Compare and relate physical properties associated with linear motion and rotational motion along with the application of conservation of angular momentum.
6) Understanding of relationships for work, energy and power and solve related problems. Explain the principle of conservation of energy also identify various forms of energy, and energy transformations.
7) Describe the phenomenon related to properties of matter such as pressure, surface tension, stress, strain, elasticity, viscosity and their effect.

Chemistry-I

1.1 Course Number: CY101
1.2 Contact Hours: 3-0-0   Credits:9
1.3 Semester-offered: 1st Year –Odd
1.4 Prerequisite: Class 10th level Chemistry and Mathematics
1.5 Syllabus Committee Members: Dr. Sabyasachi Pramanik & Dr. Souvik De

2. Objective:

i) To impart the knowledge of fundamental principles of chemistry for future learning of engineering principles
ii) To make students realize the importance of fundamental chemistry in engineering disciplines.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1.	**Atomic Structure**	Atomic number, isotopes and isobars. Thompson's model and its limitations, Rutherford's model and its limitations, Bohr's model and its limitations Quantum number, Aufbau principle, Hund's rule, Pauli's exclusion principle, electronic configuration.	8
2.	**Periodic Properties of Elements**	Classification of Elements, Significance of classification, brief history of the development of periodic table, modern periodic law and the present form of periodic table, periodic trends in properties of elements -atomic radii, ionic radii, inert gas radii Ionization enthalpy, electron gain enthalpy, electronegativity, valency. Nomenclature of elements with atomic number greater than 100. Basic Concepts of s, p, d and f-block Elements	8
3.	**Chemical Bonding and Molecular Structure**	Orbit vs. Orbital, Valence electrons, ionic bond, covalent bond; Lewis structure, polar character of covalent bond, covalent character of ionic bond, resonance, geometry of covalent molecules, VSEPR theory, concept of hybridization, involving s, p and d orbitals and shapes of some simple molecules, Valence-Bond Theory.	8
4.	**Concept of Moles and Chemical Equation**	Phases, Mole concept and problems, Standard solution, normal solution and molar solution, concentration terms-normality, molarity, gm/l, ppm, normality equation, acid-base titration. Chemical equation-definition, qualitative and quantitative significance, limitations, balancing by partial and ion-electron method, electronic concept of oxidation and reduction, Stoichiometric calculations.	7
5.	**Acids-Bases and Salt**	Acids, bases and salts, Theories of acids and bases- Arrhenius, Bronsted-Lowry, Lewis theory, Strong acids and strong bases, Concept of pH and pKa, conjugate acid-base pair, classification of salts, hydrolysis of salts and its effect, Concept of Buffer, Indicator.	7
Total			**38**

4. Readings

4.1 Textbooks:

1. NCERT Textbook (Class XI and XII)
2. Engineering Chemistry, B. K. Sharma

4.2 References Books:

1. A Textbook of Engineering Chemistry, Sashi Chawla
2. Engineering Chemistry, Jain and Jain
3. Applied Chemistry, Dr.Raman Rani Mittal

5. Outcomes of the Course:

After completion of this course students will be able to

1) Know about the structure of an atom and write the electronic configurations of atoms.

2) Understand the variation of physical and chemical properties of elements such as ionization potential, electron affinity, electronegativity and learn about the periodic table.

3) Understand chemical bonding, concept of hybridization, as well as structure and shape of molecules.

4) Impart knowledge about various atomic and molecular quantities, strength and balancing chemical reaction.

5) Explore acid-base chemistry with a focus on the equilibrium aspects of these reactions.

Engineering Mechanics

1.1 Course Number: ME101
1.2 Contact Hours: 2-1-0   Credits: 8
1.3 Semester-offered: 1st Year –Odd
1.4 Prerequisite: Class 10th level Physics & Mathematics
1.5 Syllabus Committee Members: Dr. Naveen Mani Tripathi, Dr. Sanat Kumar
   Singha, Dr. Abhimanyu Kar & Dr. Karthik Babu NB

2. Objective:

i) To develop the ability to model and analysis of mechanical engineering systems using vectorial representation of forces and moments.
ii) To be able to draw free-body diagrams of mechanical components and systems.
iii) To develop the capacity to predict the effect of force and motion in the course of carrying out the design functions of engineering.
iv) To understand the phenomenon of friction and the ability to solve problems related to the same. Ability to apply the principles of virtual work.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Basics and statics of particles**	Introduction – Units and Dimensions – Laws of Mechanics – Lami's theorem, Parallelogram and triangular Law of forces – Vector representation of forces –Vector operations of forces – additions, subtraction, dot product, cross product –Coplanar Forces – rectangular components – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility.	6
2	**Equilibrium of rigid bodies**	Free body diagram – Types of supports –Action and reaction forces – stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem – Single equivalent force -Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions	6
3	**Properties of surfaces and solids**	Centroids and centre of mass – Centroids of lines and areas - Rectangular, circular, triangular areas by integration – T section, I section, and Hollow section by using standard formula –Theorems of Pappus - Area moments of inertia of plane areas – Rectangular, circular, triangular areas by integration – T section, I section –Parallel axis theorem and perpendicular axis	6

		theorem – Principal moments of inertia of plane areas – Principal axes of inertia-Mass moment of inertia –mass moment of inertia for prismatic, cylindrical and spherical solids from first principle – Relation to area moments of inertia.	
4	**Dynamics of particles**	Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion - Newton's laws of motion – Simple problems – Impact of elastic bodies.	5
5	**Friction and rigid body dynamics**	Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction – wedge friction-. Rolling resistance -Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of simple rigid bodies such as cylinder and disc/wheel.	5
		Total	**28**

4. Readings

4.1 Textbooks:

1. Beer, F.P and Johnston Jr. E.R., "Vector Mechanics for Engineers (In SI Units): Statics and Dynamics", 8th Edition, Tata McGraw-Hill Publishing company, New Delhi (2004).
2. Vela Murali, "Engineering Mechanics", Oxford University Press (2010)

4.2 References Books:

1. Bhavikatti, S.S and Rajashekarappa, K.G., "Engineering Mechanics", New Age International (P) Limited Publishers, 1998.
2. Hibbeller, R.C and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", 11th Edition, Pearson Education 2010.
3. Irving H. Shames and Krishna Mohana Rao. G., "Engineering Mechanics – Statics and Dynamics", 4th Edition, Pearson Education 2006.
4. Meriam J.L. and Kraige L.G., " Engineering Mechanics- Statics - Volume 1, Dynamics- Volume 2", Third Edition, John Wiley & Sons,1993.
5. Rajasekaran S and Sankarasubramanian G., "Engineering Mechanics Statics and Dynamics", 3rd Edition, Vikas Publishing House Pvt. Ltd., 2005.

5. Outcome of the Course:

On successful completion of this course, the student will be able to

1) Illustrate the vectorial and scalar representation of forces and moments
2) Analyse the rigid body in equilibrium
3) Evaluate the properties of surfaces and solids
4) Calculate dynamic forces exerted in rigid body
5) Determine the friction and the effects by the laws of friction

Fundamentals of Computer Engineering

1.1 Course Number: CS101
1.2 Contact Hours: 2-0-2   Credits:8
1.3 Semester-offered: 1st Year –Odd
1.4 Prerequisite: Basic knowledge of computers
1.5 Syllabus Committee Members: Dr. Shikha Dwivedi

2. Objective:

The aim of the course is to help the students to attain the following basic competency through various teaching-learning experiences:

i) Identifying and learning about various computer hardware and their uses.
ii) Understanding of computer memory and its internal architecture.
iii) Basic knowledge of software including different operating systems and its working.
iv) Introduction to web designing using HTML coding.
v) Developing awareness regarding cyber security.
vi) Evolving logical thinking and problem-solving skills.
vii) The course will assist diploma engineers in using fundamental ideas and principles to tackle complex engineering issues and comprehend various technology-based applications.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Computer Organization**	Introduction to generations of computer and its classification, Logical organization of computer (functional block diagram), Input & Output devices (keyboard, mouse, joystick, scanner, OCR, OMR, MICR, barcode reader, web camera, monitor, printer, plotter), Central processing unit.	5
2	**Memory & Architecture**	Primary, secondary and auxiliary memory, Main memory unit, RAM, ROM, Cache memory, Registers, System bus, Hard disks & optical disks, CPU, SMPS, Motherboard, Ports and Interfaces, Expansion cards, Ribbon cables, Memory chips, Processors.	4
3	**Human Computer Interface**	Types of software (System and application), Operating system as user interface, Types of operating systems (Window, Linux, Mac), MS Office (Word, Excel, PowerPoint), Unix Shell and Commands, Programming languages, Compiler, Interpreter, VI editor, Computer viruses and its type, Detection and prevention of viruses.	5
4	**Computer Networks & Web Design**	Internet, TCP/IP, World Wide Web, Browser, Internet address (Domain name, URL), Search engine. Introduction to computer networks, Data communication and its	10

5	**Information Security**	components, Data transmission mode, LAN, MAN, WAN, Wireless LAN, Client/server network and peer-to-peer network, Intranet, Extranet. Hyper Text Mark-up Language (HTML), Cascading Style Sheet (CSS), Creating web pages, Lists, Hyperlinks, Tables, Web forms, Inserting images, Frames, Hosting options and domain name registration.	
5	**Information Security**	Protection, Security, Risk, Threat, Vulnerability, Exploit, Attack, Confidentiality, Integrity, Availability, Non-repudiation, Authentication, Authorization, Codes, Plain text, Encryption, Decryption.	3
		Total	**27**

List of Experiments:

1. Introduction to various components of Computer system.
2. Study and Practice of handling Microsoft Windows – Folder related operations, My-Computer, Window explorer, Control Panel.
3. Introduction to Microsoft Office.
4. Creation and editing of Text files using MS Word.
5. Creation and operating of spreadsheet using MS Excel.
6. Creation and editing power-point slides using MS Power Point.
7. Introduction to Unix operating system (Ubuntu).
8. Study and practice of Open Office: OpenOffice Writer, OpenOffice Spreadsheet, OpenOffice Impress.
9. Study and practice of Basic Linux Commands.
10. Study and practice of Vim editor and its various commands in different modes.
11. Introduction to inter-networking protocols, world wide web, browsers and search engines.
12. Understanding of IP addresses, significance and uses of various domain names and URLs.
13. Create webpages and webforms including lists, hyperlinks, images, table etc. by using basic HTML program with HTML tag.
14. Modify the same webpages by using CSS codes.
15. Write the complete HTML coding using CSS for the following table:

Gradesheet of Diploma Students

	Maths	Physics	Chemistry	Human Values	Communication Skills	Engineering Themodynamics
Tom	47	39	25	33	43	36
Jimi	23	45	25	37	40	39
Tus	50	43	38	44	40	37
Ross	31	30	42	35	29	22
Max	34	35	38	44	49	43

16. Write the complete HTML coding using CSS for the following form :

Admission Form for Assam Energy Institute

First Name: [enter your name] Last Name: [enter your title]

Password: [enter your password]

Select Gender: ○ Male ○ Female

Answer the following questions:

Why do you want to join Assam Energy Institute?

Which branch have you selected and why?

[Submit Form]

4. Readings:

4.1 References Books:

1. A. Goel, Computer Fundamentals, Pearson Education.
2. P. Aksoy, L. De Nardis, Introduction to Information Technology, Cengage Learning.
3. P. K. Sinha, P. Sinha, Fundamentals of Computers, BPB Publishers.
4. R. S. Salaria, Computer Fundamentals, Khanna Publishing House.
5. Ramesh Bangia, PC Software Made Easy – The PC Course Kit, Khanna Publishing House.
6. Andrew S. Tanenbaum, David J. Wetherall Computer Networks (5th Edition), PHI.
7. M. Merkow, J. Breithaupt, Information Security Principles and Practices, Pearson Education.
8. J. Minnick, Web Design with HTML5 and CSS3 (8th edition), Cengage Learning.

5. Outcomes of the Course:

After undergoing this subject, the student will be able to:

1) Describe functional units of a computer, its various peripherals and their applications.
2) Identify computer hardware as well as software (in the lab).
3) List the features of Word, Excel, PowerPoint and also able to perform calculations on excel sheet and demonstrate the use of PowerPoint for seminar presentations.
4) Identify various operating system file management commands (create, copy, move, delete and rename folders and files).
5) Demonstrate installation of application software in windows as well as in Linux operating system.
6) Acknowledge various computer languages and also able to differentiate between compiler and interpreters.
7) State computer networks such as LAN, MAN and WAN together with the internet, intranet and extranet.
8) Design basic web pages using the HTML along with the CSS.
9) Aware regarding the issues related to cyber security.

Engineering Drawing

1.1 Course Number: ME102L
1.2 Contact Hours: 0-0-3   Credits:3
1.3 Semester-offered: 1st Year –Odd/Even
1.4 Prerequisite: Class 10th level Mathematics
1.5 Syllabus Committee Members: Dr. Naveen Mani Tripathi, Dr. Sanat Kumar Singha, Abhimanyu Kar & Dr. Karthik Babu

2. Objective:

i) To understand the basic concepts of dimensioning and scales and their roles in engineering drawing.
ii) To draw orthographic projections of points, straight lines, laminae and solids when the mentioned objects are located with different configurations with respect to the plane of projections.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lab Sessions
1	**Introduction to Engineering Drawing**	1.1 Introduction to drawing instruments, materials, layout and sizes of drawing sheets and drawing boards. 1.2 Different types of lines in engineering drawing as per BIS specifications 1.3 Practice of vertical, horizontal and inclined lines, geometrical figures such as triangles, rectangles, circles, ellipses and curves, hexagonal, pentagon with the help of drawing instruments 1.4 Free hand and instrumental lettering (alphabets and numerals) – upper case (capital letters), single stroke, vertical and inclined at 75 degree, free hand and instrumental lettering in the ratio of 7:4	2
2	**Dimensioning Technique and Scales**	2.1 Necessity of dimensioning, method and principles of dimensioning (mainly theoretical instructions) 2.2 Dimensioning of overall sizes, circles, angles, tapered surfaces, holes, counter sunk holes, cylindrical parts, narrow spaces and gaps, radii, curves and arches 2.3 Scales – their needs and importance (theoretical instructions), type of scales, definition of representative fraction and length of scale	2
3	**Orthographic Projections**	3.1 Theory of orthographic projections (elaborate theoretical instructions) 3.2 Projection of Points in different quadrants 3.3 Projection of straight lines (1st angle and 3rd	5

		angle)	
		3.4 Line parallel to both the planes 3.5 Line perpendicular to any one of the reference planes 3.6 Line inclined to any one of the references plane 3.7 Projection of planes – different lamina like square, rectangular, triangular and circle inclined to one plane, parallel and perpendicular to another plane in 1st angle only. 3.8 Three views of orthographic projection of different objects	
4	**Projection and Sections of Solids**	4.1. Definition and salient features of a solid 4.2. Types of Solid (polyhedral and solids of revolution) 4.3 To make projections, sources, top view, front view and side view of various types of solids. 4.4 Importance and salient features 4.5 Drawing of full section, half section, partial or broken out sections, offset sections, revolved sections and removed sections. 4.6 Convention sectional representation of various materials, conventional breaks for shafts, pipes, rectangular, square, angle, channel, rolled sections. 4.7 Orthographic sectional views of different objects	3
5	**Isometric Views**	5.1 Fundamentals of isometric projections and isometric scale 5.2 Isometric views of combination of regular solids like cylinder, cone, cube and prism	1
Total			**13**

4. Readings

4.1 Textbooks:

1. A Textbook of Engineering Drawing by Surjit Singh; Dhanpat Rai& Co., Delhi
2. Engineering Drawing by PS Gill; SK Kataria& Sons, New Delhi
3. Elementary Engineering Drawing in First Angle Projection by ND Bhatt; Charotar Publishing House Pvt. Ltd., Anand
4. Engineering Drawing I by DK Goel, GBD Publication.

4.2 Reference Book:

1. Engineering Drawing I & II by JS Layall; Eagle Parkashan, Jalandhar

5. Outcome of the Course:

Knowledge of working with various drawing instruments.

1) Classify dimensioning methods and scales.
2) Understand the difference between first angle and third angle projection schemes.
3) Draw the orthographic and isometric views of simple objects.

Physics Laboratory

1.1 Course Number: PY101L
1.2 Contact Hours: 0-0-2   Credits:2
1.3 Semester-offered: 1st Year –Odd/Even
1.4 Prerequisite: Class 10th level Physics
1.5 Syllabus Committee Members: Dr. Shikha Dwivedi & Dr. Nimisha Raghuvanshi

2. Objective:

i) Experiments demonstrate the principle of physics covered in the theory and also provide the familiarities with various apparatus along with developing an attitude of perfection in practical tasks.
ii) The basic purpose of laboratory experiments in physics is to verify and validate the concepts, principles and hypotheses related to the physical phenomena.

3. List of Experiments:

1. To measure length, radius of a given metallic cylinder and a metallic spherical ball using a Vernier caliper and find volume of each object.
2. To determine the diameter of a wire, a metallic spherical ball and thickness of cardboard using a screw gauge.
3. To verify the laws of reflection using a plane mirror and to study the characteristics of the image formed.
4. To determine the refractive index of the material of the glass slab by pin method.
5. To locate the poles of a bar magnet and measure the magnetic length. To plot the magnetic field lines of the bar magnet.
6. a). To verify Ohm's law by Ammeter-Voltmeter method. b). Find equivalent resistance using voltmeter with three resistors connected in series and then in parallel.
7. To plot $L - T$ and $L - T^2$ graph using a simple pendulum. To find effective length of a second's pendulum using appropriate graph.
8. To study the relation between the length of a given wire and tension for constant frequency using sonometer.
9. To study the co-efficient of viscosity of a given viscous liquid by measuring the terminal velocity of a given spherical body.
10. To study the variation in volume with pressure for a sample of air at constant temperature by plotting graphs between pressure and volume.

4. Readings (Textbooks / Reference Books):

1. Textbook of Physics for Class XI& XII (Part-I, Part-II); N.C.E.R.T., Delhi.
2. Comprehensive Practical Physics, Vol, I & II, J.N. Jaiswal, Laxmi Publications (P)Ltd.
3. Practical Physics by C. L. Arora, S. Chand Publication.
4. E-books/e-tools/ learning physics software/YouTube videos/websites etc.

5. Outcomes of the Course:

After undergoing this subject, the student will be able to:

1) Use various measuring device such as Vernier Callipers and Screw Gauge.
2) Verify the laws of reflection using mirror and the laws of refraction using glass.
3) Study the magnetic field lines of a Bar magnet.
4) Verify the Ohm's law and find an unknown resistance using meter bridge.
5) Understand the relation between length and time period of simple pendulum.
6) Learn the effect & use of resonance in sonometer.
7) Determine the coefficient of viscosity of any spherical metallic body.
8) Understand the relation between volume and pressure of air using Boyle's Law.

Universal Human Values

1.1 Course Number: HU101
1.2 Contact Hours: 1-1-0   Credits: 5
1.3 Semester-offered: 1st Year –Odd
1.4 Prerequisite: NA
1.5 Syllabus Committee Members: All Faculties of AEI

2. Objective:

i) To help the student see the need for developing a holistic perspective of life.
ii) To sensitize the student about the scope of life – individual, family (inter-personal relationship), society and nature/existence
iii) To strengthen self-reflection
iv) To develop more confidence and commitment to understand, learn and act accordingly.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Motivation and Objectives of Human Values Course**	Introduction to the objectives of the course. Content and process of the course including mode of conduct. Daily life as lab for the course. Activities in the course.	1
2	**Purpose of Education**	How human being has a need for Knowledge, what should be the content of knowledge, how the content should be discussed in education. Complimentarily of skills and values, how the current education system falls short.	2
3	**Peers Pressure, Social Pressure**	In various dimensions of life, how do these things work. What is the way out? In the context of education, peer pressure etc.	1
4	**Concept of Competition and Excellence**	How competition leads to degradation of self and relationships. How excellence is the basic need of a human being. What is excellence?	1
5	**Time Management**	How does one deal with myriads of activities in college? Focus of the mind.	1
6	**Concept of Preconditioning**	How preconditioning affects our thinking, behavior, work, relationships, society and nature. How do we develop pre-conditioning? What are the various sources of preconditioning? How do we evaluate our Preconditioning? How do we come out of it?	1
7	**Concept of**	What is natural acceptance? How can the concept of	2

	Natural Acceptance in Human Being	natural acceptance be used to evaluate our preconditioning? Universal nature of natural acceptance. Are anger, jealousy, hatred natural? How do we feel when we experience them? Which feelings are natural for a human being and which are not?	
8	**Understanding Relationships**	Are relationships important? What is the role of relationships in our life? If relationships are important then why they are important? If they are important then why it is the case that we are not discussing them? What are the notions/conditions and factors which stop us to explore more into relationships? Relationships in family and extended family. Dealing with anger, Basic expectations in relationships. Seven types of relations, Gratitude as a universal value in relationships, Nine universal values in human relationships, Trust as the founding value, Concept of acceptance, Unconditional acceptance in relationships, Our preconditioning affecting our relationships, Our relationships with subordinate staff, with people of opposite gender, caste, class, race, How relationships have the power to force a person to change his preconditioning.	2
9	**Concept of prosperity Material goods**	What role others have played in making material goods available to me: Identifying from one's own life.	1
10	**Idea of Society**	What is a society? What constitutes a society? What systems are needed for a society to work? What is the purpose of society and various systems which are working in it? How understanding of Human Nature is important in order to understand the purpose of Society and various social systems? And what happens when this understanding is lacking?	1
11	**Balance in nature**	Balance which already exists in nature, How human beings are disturbing the balance. Resource depletion and pollution, our own role in wastage of electricity, water and in use of plastics, Waste management, Issues like global warming, animal extinction	1
	Total		**14**

4. Readings

4.1 Suggested Readings:

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010
2. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi

3. On Education - J Krishnamurthy
4. Siddhartha - Hermann Hesse
5. Old Path White Clouds -ThichNhatHanh
6. Diaries of Anne Frank - Anne Frank
7. Life and Philosophy of Swami Vivekananda
8. Swami Vivekananda on Himself
9. Small is Beautiful - E. F Schumacher
10. Slow is Beautiful - Cecile Andrews
11. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi
12. Rediscovering India - by Dharampal
13. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
14. India Wins Freedom -Maulana Abdul Kalam Azad
15. Autobiography of a Yogi – by ParamhansaYogananda
16. Gandhi and Question of Science – Sahasrabudhe

5. Outcome of the Course:

1. Analyze the significance of value inputs provided in formal education along with skills and develop a broader perspective about life and education.
2. Formulate their aspirations and concerns at different levels of living, and the way to fulfill them them in a sustainable manner.
3. Evaluate their current state of understanding and living and model a healthy lifestyle.
4. Examine the issues of home sickness, interactions with seniors on the campus, peer pressure with better understanding and feel grateful towards parents, teachers and others
5. Develop more confidence and commitment for value-based living in family, society and nature.

Communication Skills

1.1 Course Number: L101
1.2 Contact Hours: 2-0-1   Credits:7
1.3 Semester-offered: 1st Year –Odd
1.4 Prerequisite: Class 10th level English
1.5 Syllabus Committee Members: DUGC

2. Objective:

i) To make the students confident of speaking in English impeccably and with utmost enthusiasm.
ii) To familiarize the students with different styles of communication.
iii) To enlighten the students with the seven concepts of communication.
iv) To make the students understand the nuances of communication.
v) To train the students and make them comprehend various aspects of Interview skills.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Parts of Speech**	Recognition and review of Nouns, Pronouns, Verbs, Adverbs, Adjectives, Prepositions, Conjunctions, Interjections, Knowledge of Courses/ Subjects, Object and Compliment of the Verb, Verbals –Infinitival, Gerund and Preposition Recognition and review	3
2	**Prepositions of time and place**	Contextual teaching of prepositions of time - on, in, at, since, for, ago, before, to, past, to, from, till/until, by Prepositions of place: in, at, on, by, next to, besides, near, between, behind, in front of, under, below, over, above, across, through, to, into, towards, onto, from	3
3	**Clause, phrases and Relative Clauses**	Basic definitions of clauses and phrases, Focus on Relative Pronouns and their use in sentences as relative clauses.	2
4	**Courses/Subjects Verb Agreement**	Rules that guide the agreement of the Courses/Subjects to its verb	2
5	**Sentence types and Transformation of sentences**	Assertive sentences, Exclamatory sentences, Interrogative sentences, Negative sentences, Compound sentences, complex sentences, simple sentences, Degrees of Comparison	2
6	**Voice**	Change from Active Voice to Passive Voice and vice versa	2

7	**Punctuation**	Use of the comma, semi-colon, colon, apostrophe, exclamation mark, question mark and quotation marks	2
8	**Word formation**	Change of one part of speech to the other: from Verbs to Nouns, Nouns to Verbs, Adjectives to Nouns, Nouns to Adjectives, Verbs to adverbs, and Adverbs to Verbs	2
9	**Affixation**	Prefixes and Suffixes and new word formations	2
10	**Nominal Compounds**	Common nominal compound	2
11	**Paragraph Writing**	Descriptive Paragraph on various related topics.	2
		Total	**24**

4. Readings

4.1 Suggested Readings**:**

1. Essential English Grammar with Answers by Raymond Murphy (Cambridge University Press)
2. English for Polytechnics by Dr Papori Rani Barooah (Eastern Book House Publishers)
3. English Grammar by Annie Brinda (Cambridge University Press)

5. Outcome of the Course:

1) Develop knowledge, skills, and judgment around human communication that facilitate their ability to work collaboratively with others.
2) Understand and practice different techniques of communication.
3) Practice and adhere to the 7Cs of Communication.
4) Familiarize with different types of Communication.
5) Understand and practice Interview Etiquettes.

Semester II

Mathematics-II

1.1 Course Number: MA102
1.2 Contact Hours: 3-1-0   Credits: 11
1.3 Semester-offered: 1st Year –Even
1.4 Prerequisite: Class 10th level Mathematics
1.5 Syllabus Committee Members: Dept. of Mathematical Sciences, RGIPT

2. Objective:

This course is designed to give a comprehensive coverage at an introductory level to the subject of Determinants and Matrices, Integral Calculus, Differential Equations, Permutations & Combinations, Probability & Statistics.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Determinants and Matrices**	Elementary properties of determinants up to 3rd order, Algebra of matrices, Inverse of a matrix, Consistency of equations; Crammer's rule, Matrix inverse method to solve a system of linear equations in 3 variables.	8
2	**Integral Calculus**	Integration as inverse operation of differentiation; Simple integration by substitution, by parts and by partial fractions (for linear factors only); Definite Integral, Use of formula $\int_0^{\pi/2} \sin^n x dx, \int_0^{\pi/2} \cos^n x dx \,\& \int_0^{\pi/2} \sin^m x \cos^n x \, dx$ for solving problems where m and n are positive integers.	9
3	**Ordinary Differential Equations**	Definition of differential equations; Order and degree of a differential equation; General and particular solution of a differential equation; Formation of differential equation whose general solution is given; Solution of first order and first-degree differential equation by variable separation method; Homogeneous differential equation of 1st order, Exact differential equation, First order linear differential equation.	9
4	**Permutations & Combinations**	Definition of factorial of a number, permutation (^nP_r) & combination (^nC_r) with formula only. Binomial Theorem (without proof) for any index, simple problems on positive index only. Expansion of $(1 + x)^{-1}$, $(1 - x)^{-1}$, where $|x| < 1$, exponential & logarithmic series only (no problem).	5
5	**Probability and Statistics**	Definition & examples of frequency distribution. Measure of Central Tendency (mean, median, mode) for ungrouped frequency distribution. Measures of dispersion-Standard deviation, Simple problems. Definition of random experiment, sample space, event, occurrence of events & types of events (eg. Impossible, Mutually exclusive, Exhaustive, Equally likely). Classical definition of probability, simple problems.	9
		Total	**40**

4. Readings

4.1 Textbook:

- H. K. Das, Applied Mathematics for Polytechnics.
- B.S. Grewal, Higher Engineering Mathematics, Khana Publishers, New Delhi, 40th Edition, 2007.
- Mathematics Textbook for Class XI and XII (NCERT).

4.2 Reference Books:
1. R. D. Sharma, Mathematics for Class 11and 12.
2. R. K. Jain and S. R. K. Iyenger, Advance Engineering Mathematics, Narosa Publishing House.
3. M. D. Raisinghania, Advanced Differential Equation.
4. E. Kreyszig, Advanced Engineering Mathematics, Khanna Publisher.
5. J. J. Sciller, R. A. Srinivasan, M. R. Spiegel, Probability & Statistics, Schaum's outline series, McGraw Hill.

5. Outcome of the Course:
After the completion of the course the students will be able to
1) Understand the concept of matrices and their properties. Apply matrix operations to real-world problems, such as transformations and Markov chains.
2) Apply integration to solve problems in physics, engineering, and economics.
3) Solve first-order ODEs using various methods, such as separation of variables, integrating factors, and exact equations.
4) Understand the fundamental principles of permutations-combinations & probability-statistics.

Physics-II

1.1 Course Number: PY102
1.2 Contact Hours: 3-1-0   Credits: 11
1.3 Semester-offered: 1st Year – Even
1.4 Prerequisite: Class 10th level Physics &Mathematics
1.5 Syllabus Committee Members: Dr. Shikha Dwivedi & Dr. Nimisha Raghuvanshi

2. Objective:

i) Physics is a core science subject from which all engineering technologies have evolved, a thorough understanding of the basic principles and applied aspects will assist students in understanding, applying, and evolving technologies more effectively, thereby improving the quality of life in society.
ii) This course will provide the knowledge of the physical environment through observations and predictions.
iii) The course attempts to enhance the student's factual knowledge along with the applications. This will foster a scientific mindset and aid in the application of fundamental concepts and principles to engineering and technology-based challenges.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Wave motion and its applications**	Wave motion, Transverse and longitudinal waves with examples, Definitions of wave velocity, Frequency and Wavelength and their relationship, Sound and light waves and their properties, Wave equation, Amplitude, Phase, Phase difference, Principle of superposition of waves and beat formation. Simple Harmonic Motion (SHM): Definition, Expression for displacement, Velocity, Acceleration, Time period, Frequency. Simple harmonic progressive wave and energy transfer, Free, Forced and resonant vibrations with examples, Acoustics of buildings. Ultrasonic waves: Introduction and properties, Applications of ultrasonics in engineering and medicals.	9
2	**Optics**	Basic optical laws of reflection and refraction, Refractive index, Images and image formation by mirrors, Lens and thin lenses, Lens formula, Power of lens, Magnification and defects. Total internal reflection, Critical angle and conditions for total internal reflection, Applications of total internal reflection.	6
3	**Electrostatics**	Coulomb's law, Electric field, Electric lines of force and their properties, Electric flux, Electric potential and potential difference, Gauss law: Application of Gauss law, Calculation of electrostatic potential at a point due to point charge, Relation between potential and electric field intensity. Capacitor and its working, Types of capacitors, Capacitance and its units. Capacitance of a parallel plate capacitor, Series	9

		and parallel combination of capacitors (related numerical), Dielectric and its effect on capacitance, Dielectric breakdown.	
4	**Current Electricity**	Electric Current, Resistance, Specific resistance, Conductance, Specific conductance, Series and parallel combination of resistances. Factors affecting resistance of a wire, Ohm's law and its verification, Kirchhoff's laws. Cells, Internal resistance, Concept of terminal voltage and Electromotive force (EMF). Chemical effect of current, Electrolysis, Faraday's law of electrolysis, Heating effect of current, Joule's law, Electric power, Electrical energy and related numerical problems, Advantages of electrical energy over other forms of energy.	8
5	**Magnetism & Electromagnetism**	Inverse square law of magnetism, Magnetic field and intensity, Magnetic lines of force, Magnetic flux, Ampere's circuital law, Solenoid, Torque on a current loop, Magnetic moment, Magnetic dipole, Moving coil galvanometer, Conversion of a galvanometer into ammeter and voltmeter. Uniform & non-uniform field, Magnetization, Earth's magnetism, Permanent magnets and electromagnets, Types of magnetic materials: Dia, para and ferromagnetic with their properties. Electromagnetic induction, Faraday's Laws, Lenz law, Self and mutual induction, Motional electromotive force, Eddy currents, Alternating current, Transformers (step-up & step-down), Displacement current, EM waves and its spectrum.	10
		Total	42

4. Readings

4.1 Textbooks:

1. Textbook of Physics for Class XII (Part-1, Part-2); N.C.E.R.T., Delhi

4.2 Reference Books:

1. Applied Physics, Vol. I and Vol. II, TTTI Publications, Tata McGraw Hill, Delhi.
2. Concepts in Physics by H. C. Verma, Vol. I & II, Bharti Bhawan Ltd., New Delhi.
3. Engineering Physics by P. V. Naik, Pearson Education Pvt. Ltd., New Delhi.
4. Engineering Physics by H. K. Malik and A. K. Singh, Mc Graw Hill.
5. Modern approach to Applied Physics- I and II, A. S. Vasudeva, Modern Publishers.
6. A Textbook of Optics, N. Subramanyam, Brij Lal, M. N. Avahanulu, S Chand and Company Ltd.
7. Introduction to Fiber Optics, Ajoy Ghatak and K. Thyagarajan, Cambridge University Press India Pvt. Ltd., New Delhi.

5. Outcomes of the Course:

After undergoing this subject, the student will be able to;

1) Explain wave motion, periodic motion as well as simple harmonic motion and their basic parameters such as amplitude, frequency, wavelength, velocity and related numerical problems. Also, able to describe ultrasonic waves and its applications in engineering, medical and industrial areas.

2) Understand the basic optical laws of refraction and reflection, establish the location and characteristics of the images formed by mirrors and lenses. Also, able to explain critical angle, total internal reflection and its applications.

3) Describe electric filed, electric flux, electric potential along with the examples, also able to explain the function of capacitors in simple circuits and solve simple problems.

4) Express electric current as flow of charge and concept of resistance. Also, able to list the effects of an electric current and its common applications, state Ohm's law, calculate the equivalent resistance of a variety of resistor combinations, determine the energy consumed by an appliance, Faraday's law, Joule's law and their numerical applications.

5) Understand magnetism, its intensity, flux and related laws, explain the operation of appliances like moving coil galvanometer. Also, able to differentiate among different types of magnetic materials for engineering applications, learn the eddy currents, alternating current, displacement current and applications of electromagnetic induction in transformers.

6) Have basic idea of atomic structure and modern Physics regarding wave-particle duality, uncertainty principle.

Chemistry-II

1.1 Course Number: CY102
1.2 Contact Hours: 3-0-0   Credits:9
1.3 Semester-offered: 1st Year –Even
1.4 Prerequisite: Class 10th level Chemistry & Mathematics
1.5 Syllabus Committee Members: Dr. Sabyasachi Pramanik & Dr. Souvik De

2. Objective:

i) To apply the fundamental concepts of chemistry for the understanding of process and technology relevant to industry.
ii) To become familiar with the scope, methodology, and application of modern chemistry and to learn to appreciate its ability to explain the physical world.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Organic Chemistry**	General introduction, IUPAC nomenclature of organic compounds. Electronic displacements in a covalent bond: inductive effect, electrometric effect, resonance and hyper conjugation. Homolytic and heterolytic fission of a covalent bond: free radicals, carbocations, carbanions; electrophiles and nucleophiles, types of organic reactions. Classification of Hydrocarbons: Aliphatic Hydrocarbon-Alkane, Alkene, Alkyne. Aromatic Hydrocarbon- Benzene: resonance, aromaticity; chemical properties: mechanism of electrophilic substitution – nitration sulphonation, halogenation, Friedel Craft's alkylation and acylation.	9
2	**Fuels & Combustion**	Sources of Energy, Fuels- classification, examples, relative merits, types of coal, Gaseous fuels: LPG, natural gas, CNG: Composition and applications. determination of calorific value of solid fuels, Bomb calorimeter, Knocking and anti-knocking for petrol and diesel (octane number and cetane number) - diesel index.	8
3	**Environmental Chemistry**	Industrial revolutions and pollution. Air/water/ soil pollution, greenhouse gas & effect, chemical reactions involved, acid rain, effects of depletion of ozone layer, greenhouse effect and global warming – pollution due to industrial wastes; pollution due to industrial wastes; strategy for control of environmental pollution.	6
4	**Chemical Kinetics**	Rate of a reaction (average and instantaneous), factors affecting rates of reaction: concentration, temperature, catalyst; order and molecularity of a reaction; rate law and specific rate constant, integrated rate equations and half life (only for zero and first order reactions); concept of collision theory (elementary idea, no mathematical treatment). Activation energy, Arrhenius equation.	8

5	**Electrochemistry**	Redox reactions; conductance in electrolytic solutions, specific and molar conductivity variations of conductivity with concentration, Electrochemical cells: Galvanic cell (daniel cell); Electrode potential; electrochemical series and its applications; Nernst equation and it's application. Fundamental concept of corrosion.	8
		Total	**39**

4. Reading

4.1 Textbooks:

1. NCERT Textbook (Class XI and XII)
2. Engineering Chemistry, B. K. Sharma

4.2 References Books:

1. A Textbook of Engineering Chemistry, Sashi Chawla
2. Engineering Chemistry, Jain and Jain
3. Applied Chemistry, Dr.Raman Rani Mittal

5. Outcome of the Course:

After completion of this course students will able to

1) Explain why the element carbon gives rise to a variety of compounds, and how those organic compounds are classified and will learn about the naming of organic compound and basic concept of mechanism of organic reactions.

2) Understand the importance of chemistry related to the environment, energy and fuels and importance of fuels in our daily life. Knowledge of environmental pollutions, green chemistry.

3) Understand the factors that influence chemical reaction rates, reaction mechanisms, and the quantitative techniques used to describe those rates.

4) Understand the fundamental aspects of redox chemistry and the technologies made possible from discoveries in the field of electrochemistry and to identify the appropriate materials, design and operation conditions to reduce the likelihood of corrosion in engineering systems and operations.

Fundamentals of Electrical and Electronics Engineering

1.1 Course Number: EE101
1.2 Contact Hours: 3-1-0   Credits: 11
1.3 Semester-offered: 1st Year –Even
1.4 Prerequisite: Class 10th level Mathematics & Science
1.5 Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani & Dr. Santosh Kumar Verma

2. Objective:

i) To impart basic knowledge of electrical quantities such as current, voltage, power, energy and frequency to understand the impact of technology in a global and societal context.
ii) To introduce the students about domestic wiring, the functioning of various electrical apparatus and the safety measures. Emphasize the effects of electric shock and precautionary measures.
iii) To establish the basic knowledge of DC and AC electric circuits and magnetic circuits and its application in generators, motors, transformers.
iv) To introduce the students about basic knowledge of electronic components like Diode, BJT, FETs, Op-Amp, Digital Circuits etc. and their application.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**DC Circuit Analysis**	Electrical circuit elements (R, L and C), voltage and current sources, Series and parallel resistive circuits, Ohm's Law, Kirchhoff's current and voltage laws, Nodal and Mesh analysis of simple circuits. Source Transformation, Superposition Theorem, Thevenin and Norton's Theorem.	9
2	**AC Circuit Analysis**	A.C. Circuits: Cycle, Frequency, Periodic time, Amplitude, Angular velocity, RMS value, Average value, Form Factor, Peak Factor, impedance, phase angle, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations. Three phase balanced circuits, voltage and current relations in star and delta connections.	8
3	**Magnetic Circuits and Electrical Machines**	Electromagnetic induction, Faraday's laws of electromagnetic induction, Lenz's law; Dynamically induced emf; Statically induced emf; Equations of self and mutual inductance; Ideal and Practical transformer, Principle of operation, EMF equation. Construction and Working principle of AC and DC machines; Basic equations and characteristic of motors.	7
4	**Semiconductor Devices**	Energy bands in solids, Types of materials (insulator, semi-conductor, conductor), intrinsic and extrinsic semiconductors, p-n junction, junction diode and V-I characteristics, types of diodes. Diode as rectifier –half wave and full wave rectifier, Working of BJT, BJT as	9

5	**Introduction to Analog and Digital Circuits**	Introduction to Operational Amplifiers-Ideal, Practical Op-Amp, Inverting and Non-inverting amplifier. Introduction to Boolean Algebra, Logic Gates and their implementation as adder and subtractor, Flip-Flop and its application.	8
		amplifier.	
		Total	**41**

4. Readings

4.1 Recommended Books:

1. Ritu Sahdev, Basic Electrical Engineering, Khanna Publishing House
2. Mittle and Mittal, Basic Electrical Engineering, McGraw Education, New Delhi, 2015, ISBN :978-0-07-0088572-5
3. Saxena, S. B. Lal, Fundamentals of Electrical Engineering, Cambridge University Press, latest edition ISBN : 9781107464353
4. Theraja, B. L., Electrical Technology Vol – I, S. Chand Publications, New Delhi, 2015, ISBN: 9788121924405
5. Theraja, B. L., Electrical Technology Vol – II, S. Chand Publications, New Delhi, 2015, ISBN:9788121924375
6. Jegathesan, V., Basic Electrical and Electronics Engineering, Wiley India, New Delhi, 2015, ISBN : 97881236529513
7. Sedha, R.S., A text book of Applied Electronics, S.Chand, New Delhi, 2008, ISBN-13: 978-8121927833
8. Malvino, Albert Paul, David, Electronics Principles, McGraw Hill Education, New Delhi,2015, ISBN-13: 0070634244-978
9. Mehta, V.K., Mehta, Rohit, Principles of Electronics, S. Chand and Company, New Delhi, 2014, ISBN-13-9788121924504

5. Outcome of the Course:

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

1) Demonstrate an understanding of the basic knowledge of electrical quantities such as current, voltage, power, energy and frequency to understand the impact of technology in a global and societal context.
2) Demonstrate an understanding of basic concepts of analysis of simple DC and AC circuits used in electrical devices like generators, motors and transformers etc.
3) Demonstrate an understanding of basic concepts of semiconductor material, electronics devices, and Digital electronics to perform the multidisciplinary tasks.

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Computer Programming

1.1 Course Number: CS102
1.2 Contact Hours: 2-0-2   Credits:8
1.3 Semester-offered: 1st Year –Even
1.4 Prerequisite: Class 10th level Computer knowledge
1.5 Syllabus Committee Members: Dr. Rupjit Saikia & Dr. Satish Kumar Tiwari

2. Objective:

To enable student, develop structured solutions to problems and implementing them using computers. This involves two parts: i) Formulating a solution for a given problem as a well-defined sequence of actions, and ii) Expressing solution in a machine-readable form or a programming language.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Basics of C Programming**	1.1 Introduction to number system 1.2 Introduction to flowchart and algorithm 1.3 History of C, where C stands 1.4 C character set, tokens, constants, variables, keywords 1.5 C operators (arithmetic, Logical, assignment, relational, increment and decrement, conditional, bit wise, special, operator precedence), C expressions data types. 1.6 Formatted input, formatted output.	6
2	**Decision Making**	2.1 Decision making and branching if statement (if, if-else, else-if ladder, nested if-else) Switch case statement, break statement. 2.2 Decision making and looping while, do, do-while statements for loop, continue statement.	9
3	**Arrays and Strings**	3.1 Arrays Declaration and initialization of one dimensional, two dimensional and character arrays, accessing array elements. 3.2 Declaration and initialization of string variables, string handling functions from standard library (strlen(), strcpy(), strcat(), strcmp()).	6
4	**Functions and Structures**	4.1 Functions: Need of functions, scope and life time of variables, defining functions, function call (call by value, call by reference), return values, storage classes. category of function (No argument No return value, No argument with return value, argument with return value), recursion. 4.2 Structures: Defining structure, declaring and accessing structure members, initialization of structure, arrays of structure.	7
	Total		**28**

4. Readings

4.1 Recommended Books:

1. Programming in C by Sachaum Series, McGraw Hills
2. Programming in C by Kerning Lan and Riechle Prentice Hall of India, New Delhi
3. Programming in C by BalaguruSwamy, Tata McGraw Hill, New Delhi
4. Let us C by Yashwant Kanetkar, BPB Publications, New Delhi
5. Vijay Mukhi Series for C and C++
6. Programming in C by R Subburaj,Vikas Publishing House Pvt Ltd.,Jangpura, New Delhi
7. Programming in C by Kris A Jansa, Galgotia Publications Pvt. Ltd., Daryaganj, New Delhi
8. Programming in C by BP Mahapatra, Khanna Publishers, New Delhi
9. Elements of C by MH Lewin, Khanna Publishers, New Delhi

5. Outcome of the Course:

Student will be able to computationally formulate basic problems and write code snippets to execute them. Also, the students will be able to take decisions when to use an array, when to use loop and when to use conditional statements.

Engineering Workshop Practices Laboratory

1.1 Course Number: ME103L

1.2 Contact Hours: 0-0-3   Credits:3

1.3 Semester-offered: 1st Year –Odd/Even

1.4 Prerequisite: Class 10th level Mathematics

1.5 Syllabus Committee Members: Dr. Naveen Mani Tripathi, Dr. Sanat Kumar Singha, Dr. Abhimanyu Kar & Dr. Karthik Babu NB

2. Objective:

i) To get a hands-on basic training of various common manufacturing processes

ii) To understand the feasibility of different manufacturing processes depending on the raw materials and the product.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lab Sessions
1	**Carpentry**	Study of the joints in roofs, doors, windows and furniture, Hands-on-exercise: oodwork, joints by sawing, planning and cutting	2
2	**Fitting Shop**	Introduction and practice of various fitting processes: Use of hand tools in fitting, preparing a male and female joint of M.S.	3
3	**Welding Shop**	Introduction and practice of various Welding processes: Electric Arc welding Practice and Gas welding, TIG, MIG, Gas Cutting and application. Joints such as a Lap joint, a T-joint or a Butt joint are to be prepared.	2
4	**Machine Shop**	Introduction and practice of various Machining processes: Plain and Stepped cylindrical turning, grooving, knurling and Thread-cutting of a job in lathe.	3
5	**Sheet Metal Work**	Basics of Sheet Metal Work, essential properties required for sheet metal (malleable and formable), Forming & Bending, Model making – Trays and funnels, Different type of joints.	2
	Total		12

4. Readings

4.1 Textbooks:

1. Elements of Workshop Technology, Vol. I and II by Hajra Choudhary, Khanna Publishers

4.2 Reference Books:

1. Workshop Technology by WAJ Chapman, Viva Books
2. Workshop Manual by Kannaiah / Narayana,Scitech

5. Outcome of the Course:

1) Practical knowledge of the several manufacturing processes
2) Skills developed in carpentry, fitting welding, machining and sheet metal work
3) Basic idea of how things are produced in the industry

Chemistry Laboratory

1.1 Course Number: CY101L
1.2 Contact Hours: 0-0-2   Credits:2
1.3 Semester-offered: 1st Year –Odd/Even
1.4 Prerequisite: Class 10th level Chemistry
1.5 Syllabus Committee Members: Dr. Sabyasachi Pramanik & Dr. Souvik De

2. Objective:

i) To incorporate the habit of working in laboratory while maintaining discipline, safety and integrity.
ii) To provide hands-on experience on the basic methods of quantitative analysis.

3. Course Content:

Sl. No.	List of Experiments
1	Introduction of a Chemistry Laboratory
2	Preparation of standard solution of oxalic acid or potassium permanganate.
3	Determination of strength of given sodium hydroxide solution by titrating against standard oxalic acid solution using phenolphthalein indicator
4	Standardization of $KMnO_4$ solution using primary standard oxalic acid solution.
5	Determination of Fe content in Mohr Salt using $KMnO_4$ solution
6	Estimation of total hardness of given water sample using standard EDTA solution
7	Determination of Alkalinity of given water sample using known concentration of an acid
8	Determination of pH of given water sample
9	Determination of the total dissolved solid of a given water sample
10	Determination of viscosity of a solution using Ostwald viscometer

4. Outcome of the Course:

1) To prepare solution of a given strength
2) To use basic laboratory techniques and equipment such as titration, pH meter, viscometer etc.
3) To estimate of strength of acid /base and ions present in domestic/industry water
4) To estimate iron content in metal and alloys
5) To determine the quality of domestic/industry water

Fundamentals of Electrical and Electronics Engineering Laboratory

1.1 Course Number: EE101L

1.2 Contact Hours: 0-0-2   Credits:2

1.3 Semester-offered: 1st Year –Even

1.4 Prerequisite: Class 10th level Mathematics & Science

1.5 Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani &
Dr. Santosh Kumar Verma

1. Introduction to basic electrical circuit elements (R, L and C).
2. Study of CRO.
3. Measurement of Amplitude, Frequency and Time-period with the help of CRO.
4. Verification of the ohm's law.
5. Verification of KCL and KVL.
6. Verification of Mess and Nodal Analysis for the given circuits.
7. Verification of Basic Theorems (Thevenin, Norton and Superposition).
8. Study of Step-up and Step-down Transformer.
9. Analysis of RLC circuit.
10. Study of speed control of DC motor.
11. Study of V-I Characteristics of PN-Junction Diode.
12. Study the operation of Half Wave and Full Wave rectifier.
13. Study of BJT and FET Characteristics.
14. Study the operation of Op-Amp in Inverting and non-inverting mode.
15. Verification of Basic Logic Gates.

Recommended Books:

1. Mittle and Mittal, Basic Electrical Engineering, McGraw Education, New Delhi, 2015, ISBN :978-0-07-0088572-5
2. Theraja, B. L., Electrical Technology Vol – I, S. Chand Publications, New Delhi, 2015, ISBN: 9788121924405
3. Sedha, R.S., A textbook of Applied Electronics, S. Chand, New Delhi, 2008, ISBN-13: 978-8121927833
4. Mehta, V.K., Mehta, Rohit, Principles of Electronics, S. Chand and Company, New Delhi, 2014, ISBN-13-9788121924504.

Community Internship

1.1 Course Number: HU103
1.2 Contact Hours: 1-1-0   Credits: 5
1.3 Semester-offered: 1st Year –Even
1.4 Prerequisite: NA
1.5 Syllabus Committee Members: All Faculties of AEI

2. Objective:

i) Explore career alternatives prior to graduation.
ii) Integrate theory and practice.
iii) Assess interests and abilities in their field of study.
iv) Learn to appreciate work and its function in the economy.
v) Develop work habits and attitudes necessary for job success.
vi) Develop communication, interpersonal and other critical skills in the job interview process.
vii) Build a record of work experience.
viii) Acquire employment contacts leading directly to a full-time job following graduation from college.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	Understanding Society	Understanding Society Social structure and relationships, Social institutions and social groups, Socialization and social control: development of self	2
2	Community Health	Illness and Disease, Health and public health: Meaning, components, determinants of health, Wellbeing and Quality of life, Health as an aspect of social development, Nutrition and malnutrition, Community Health: relevance, needs assessment, developing mechanisms for people's participation, Community Mental Health	3
3	**Working with Groups**	Social Groups: Definitions, characteristics, functions and group structure, Principles of group work and Models of group work practice, Leadership - Theories of leadership, roles and responsibilities of group leader, Leadership Power, Leadership Styles, Leadership in Administration, Techniques and skills in group work, Group worker: roles and functions	2

4	**Work with Communities**	Understanding Community: Definitions, types, approaches and framework, Community dynamics: Caste, class, religion and gender, Issues of identity, inclusion and exclusion, Community power structure, Community organization- principles, steps and process, Community work and community participation - Strategies and principles; Models and processes, Professionalism and inculcation of ethics in community practice	3
5	**Personality Development**	Definition of Personality, Determinants of Personality- biological, psychological and sociocultural factors, Communication, Flow and barriers of Communication, Listening, Spirituality and its role in personality development Stress: Causes, Management and Impact, Groups in organization, Interactions in group, Group Decision Taking, Team Building	2
6	**Development Communication**	Communication: concept, principles and its significance Process of Communication, Forms of communication: Verbal, non-verbal and written. Self-awareness in communication Barriers to communication	2
		Total	**14**

4. Readings

4.1 Suggested Readings:

1) Davis, K. 1969. Human Society, New York: The Macmillan.
2) Giddens, A.1999. Sociology, Cambridge: The Polity Press.
3) Dasgupta, M. & Lincoln, C.C. 1996, Health, Poverty and Development in India. New Delhi: Oxford University Press.
4) Trecker, H.B. 1972, Social Group Work: Principles and Practices. New York: Association Press.
5) Weil, M. (ed,) 1996, Community Practice: Conceptual Models. New York: The Haworth Press Inc.
6) Hergenhahn, B. R., &Olson., M. H. 2003, An Introduction to Theories of Personality, New Jersey: Prentice Hall.

5. Outcome of the Course:

As a result of participation in the course, students will be able to:

1) Assess and improve upon their own cultural competency skills.
2) Demonstrate understanding of theory and research guiding positive youth development programs.
3) Develop familiarity with positive youth development programs and approaches in building relationships with families and communities.
4) Understand how observation, documentation, and assessment are used to support children and families.
5) Develop applied professional skills to foster positive developmental outcomes for children and families.

Semester III

Basics of Geological Science

1.1 Course Number: PE201
1.2 Contact Hours: 3-0-0   Credits:9
1.3 Semester-offered: 2nd Year –Odd
1.4 Prerequisite: NA
1.5 Syllabus Committee Members: Dr. Chinmoy Jit Sarma, Dr. Satyajit Chowdhury, Dr. Sekhar Gogoi
    & Dr. Srawanti Medhi

2. Objective:

The objective of this course is to help participants attain the aspects of geology. It will cover the fundamentals involved in understanding the rock formations and minerals. It will also cover structures and features of rock formations that may be favourable for hydrocarbon storage in the form of crude oil and gas. Also, information about sedimentary basins and plate movements of earth will be presented. A brief introduction to basics of Geophysics will be covered in the subject.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Introduction**	Introduction, parts of earth- Atmosphere, lithosphere, Hydrosphere; subdivisions of geology, Introduction to petroleum geology	3
2	**Geological process works and rock formation**	Introduction, geological works of atmosphere (rock formation- rock weathering: physical and chemical), water (streams/rivers, sea, groundwater), glaciers	3
3	**Mineralogy**	Introduction, Properties- Physical and optical, Formation of minerals from magma, gases, recrystallization, solution; Common rock forming minerals.	4
4	**Structural features of Rocks**	Basics: Introduction, Primary and secondary structures, basic terms, stratigraphy and sequence stratigraphy; Folds and folding: Introduction, parts of fold, causes, classifications; Faults and faulting: Introduction, Classification, effects, recognition and causes, fault analysis; Joints and jointing: Introduction, Classification, Occurrences, Origins; Unconformity: Introduction, origin and types	5
5	**Study of Rocks Part A**	Introduction, Igneous rocks: definition, forms of igneous rocks -Concordant, disconcordant, igneous extrusions; Classification of igneous rocks, important igneous rocks	3
6	**Study of Rocks Part B**	Sedimentary rocks: Introduction, Formation of sedimentary rocks – mechanical, chemical, organic; classification of sedimentary rocks – clastic, non-clastic; important sedimentary rocks	6

7	**Study of Rocks Part C**	Metamorphic rocks: Introduction, classification of metamorphic rocks, important metamorphic rocks.	3
8	**Sedimentary basins and Plate tectonics**	Sedimentary basins: Introduction, Types of sedimentary basins, petroleum systems; Plate Tectonics: Introduction, Plate boundaries- transform, divergent, convergent; current plates of the earth.	3
9	**Introduction to Geophysics**	Introduction, Gravity surveys: gravity measuring instruments, gravity survey, gravity anomalies, Gravity corrections, applications, Magnetic survey - Geo-magne, magnetic field, field method of magnetic surveys, application of magnetic survey; Seismic survey: Seismic sources, receivers, Seismic reflection and refraction survey, applications	6
Total			**36**

4. Readings

 4.1 Suggested Books:

1. Geology of Petroleum, A.I. Levorsen, CBS Publishers
2. Elements of Petroleum Geology, R.C. Shelly, Elsevier Science Publishing Co.
3. Engineering and General Geology, Parvin Singh, Katson Books
4. Textbook of Geology, P.K. Mukherjee, World Press Private Limited
5. Textbook of Physical Geology, G.B. Mahapatra, CBS Publishers
6. Textbook of Geology, G.B. Mahapatra, CBS Publishers
7. Principles of Engineering Geology, K.M.Bangar, Standard Publishers

5. Outcome of the Course:

The students will be able to:

1) Understand the basics of geology and its importance in oil and gas exploration.
2) Get an idea of the different rock minerals and rock types.
3) Understand about basins and plate tectonics.

Reservoir Engineering-I

1.1 Course Number: PE202
1.2 Contact Hours: 3-1-0   Credits: 11
1.3 Semester-offered: 2nd Year –Odd
1.4 Prerequisite: Concepts of Physics and Mathematics
1.5 Syllabus Committee Members: Dr. Chinmoy Jit Sarma, Dr. Satyajit Chowdhury,
    Dr. Sekhar Gogoi & Dr. Srawanti Medhi

2. Objective:

i) To help the students understand the fundamentals and relevance of reservoir engineering in the broader context of Oil/Gas Field Exploitation, and have in-depth knowledge of vital aspects of elements of reservoir engineering in particular-

ii) To enable students to understand fluid properties existing in hydrocarbon reservoir and apply laws of fluid flow through porous media and their applicability under various field conditions.

iii) To empower students with the resource analysis expertise through extensive evaluation of hydrocarbon reservoir with respect to reserve estimations, recovery factors and ensure a positive economic gain.

iv) To enable students to emulate and simulate the reservoir parameters and use the same in futuristic R&D of their respective research areas and concerns in and around fluid mechanics such as energy, health etc. across multidisciplinary domains.

v) To equip students with multidisciplinary approach of problem-solving professional way by using commercial software packages, data analysis and presentation, numerical simulations etc.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Introduction**	Introduction to reservoir engineering	5
2	**Characteristics**	Characteristics of crude oil and natural gas, classification of crude and its physicochemical properties.	6
3	**Reservoir Rock Properties**	Porosity and permeability determination, combination of permeability in parallel & series beds, porosity permeability relationship, fluid saturation determination and significance, effective and relative permeability, wettability, capillary pressure characteristics, measurements and uses. Coring and Core Analysis.	8

		Phase behavior of hydrocarbon system, ideal & non-ideal system, equilibrium ratios, reservoir fluid sampling, PVT properties determination, different correlations and laboratory measurements, data reduction, evaluation and application.	
4	**Reservoir Fluids**	Phase behavior of hydrocarbon system, ideal & non-ideal system, equilibrium ratios, reservoir fluid sampling, PVT properties determination, different correlations and laboratory measurements, data reduction, evaluation and application.	7
5	**Flow of Fluids through Porous Media**	Darcy's law, single and multiphase flow, linear, radial & spherical flow, steady state & unsteady state flow, GOR, WOR equations.	8
6	**Reservoir Drives**	Reservoir drive mechanics and recovery factors.	4
Total			**38**

4. Readings

4.1 Textbooks:

1. Tarek Ahmed, "Reservoir Engineering Handbook", Gulf Professional Publishing, 4th ed, (2010).
2. NnaemekaEzekwe, "Petroleum Reservoir Engineering Practice", Pearson Education, Inc, (2010).

4.2 Reference Books:

1. Benjamin Cole Craft, Murray Free Hawkins, and Ronald E. Terry, "Applied Petroleum Reservoir Engineering" by Prentice Hall, (1991).
2. LP Dake, "Fundamentals of Reservoir Engineering" shell learning and development, (1998).
3. Tarek Ahmed, Paul D. McKinney, "Advanced Reservoir Engineering" Gulf Professional Publishing, 4th ed, (2005).
4. BF Towler, "Fundamental Principles of Reservoir Engineering", SPE, (2002).
5. Heriot Watt, "Reservoir Engineering Handbook".
6. Abhijit Y. Dandekar, "Petroleum Reservoir Rock and Fluid Properties", CRC Press, (2013).

5. Outcome of the Course:

1) Gain the knowledge of reservoir properties of rocks
2) Calculate the properties of reservoir fluid.
3) Gain insight into vapor – liquid, liquid – solid phase equilibrium during oil & gas production.
4) Understand the phenomenon of multiphase flow system in porous media and Equations for the calculation of required parameters applied in Reservoir Engineering.
5) Understand and explain different drive mechanisms and recovery factor of a Reservoir.
6) Calculate reserves of oil and gas by volumetric and material balance and acquire the Basics knowledge of Reservoir Modeling Software's

Production Engineering-I

1.1 Course Number: PE203
1.2 Contact Hours: 3-0-0   Credits: 9
1.3 Semester-offered: 2nd Year –Odd
1.4 Prerequisite: NA
1.5 Syllabus Committee Members: Dr. Chinmoy Jit Sarma, Dr. Satyajit Chowdhury,
    Dr. Sekhar Gogoi & Dr. Srawanti Medhi

2. Objective:

i) Gain the fundamental concepts in petroleum production engineering.
ii) Understand crude oil recovery methods from subsurface reservoirs
iii) Understand application of artificial lift methods on production depletion.
iv) Identify sand problem and its control

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Introduction to Oil Recovery methods**	Recovery Techniques: Primary recovery, Secondary recovery, Improved Oil Recovery, Enhanced Oil Recovery, Recovery factor.	4
2	**Well Completion and Equipment**	Wellhead Equipment, Christmas tree, valves, hangers, flow control devices, packers, tubular and flow lines. Perforating Oil & Gas Wells - Conventional and Unconventional techniques viz. Through tubing and tubing conveyed underbalanced perforating techniques, type size and orientation of perforation holes.	8
3	**Well Activation Methods**	Well Activation methods, Coiled Tubing unit, Down-hole equipment selection, servicing, installation & testing, smart wells- intelligent completions.	6
4	**Artificial Lift Completion**	Gas lift- Continuous and intermittent gas lift, unloading operations, gas lift valve components and mechanics, Plunger lift, chamber lift Mechanical pumping-Sucker Rod Pumping, components and operation, SRP installation, ESP-components and operation, Jet pump, Hydraulic pump-operation and components, Progressive Cavity Pump.	12
5	**Sand Control**	Introduction, Types of formation sand, effects of excess sand production, causes, Sand Control Mechanism, Gravel Pack: size, requirement, carrier fluid, hardware, gravel placement.	6
Total			**36**

4. Readings

4.1 Textbooks:

1. Petroleum Production Engineering: A computer Assisted Approach, BoyunGuo, William C. Lyons, Ali Ghalambor, Elsevier Science & Technology Books, 2007.
2. Production Operations, (2-Volume Set: Volume I & Volume II), Thomas O. Allen and Alan P. Roberts.
3. Well Completion Design, Jonathan Bellarby.
4. Technical Manual on Work-over Operation by IOGPT, ONGC

4.2 Reference Books:

1. Production Technology I-II, Institute of Petroleum Engineering, Herriot Watt University.
2. Petroleum Engineering Handbook by Howard B. Bradley
3. Non-Technical guide to Petroleum Geology, Exploration, Drilling and Production - Norman J Hyne
4. Dictionary of Petroleum Exploration, Drilling & Production by Norman J, Hyne
5. Petroleum Production Systems, M. J. Economides, A. Daniel Hill & C. E. Economides, Prentice- Hall, N. J – 07488, 1994.

5. Outcome of the Course:

After the course, the students will be able to:

1) Determine the well head pressure, down-hole pressure and operating oil/ gas flow rates of the reservoir.
2) Identify formation damage and find remedial methods to bring the well back into production.
3) Screen, design and operate artificial lifts on reservoir pressure depletions.
4) Handle in case of any crisis at drilling/production installations.
5) Contribute to reservoir management as production engineers to prolong the reservoir life with optimum production.

Drilling Engineering-I

1.1 Course Number: PE204
1.2 Contact Hours: 3-0-0   Credits:9
1.3 Semester-offered: 2nd Year –Odd
1.4 Prerequisite: NA
1.5 Syllabus Committee Members: Dr. Chinmoy Jit Sarma, Dr. Satyajit Chowdhury,
    Dr. Sekhar Gogoi & Dr. Srawanti Medhi

2. Objective:

The objectives of this course are to give an overview of the role of drilling engineers in oil and gas industries. It will help to understand the plan of drilling a well, the process of drilling and various equipment used for drilling as well the drill string. It will focus on the importance of drilling fluid and its properties. Also, the course will shed light on understanding casing and cementing operations and a brief introduction to different borehole problems.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Overview of drilling**	Drilling planning approaches, drilling team, types of drilling, power systems	5
2	**Hoisting system**	Derrick & substructure, steel derricks, making a connection, tripping operation, draw-works, travelling assembly: crown block, travelling block & hook, drilling line, static crown load.	6
3	**Drill String**	Drill string, drill string components, and design, stretch of drilling pipe, drill pipe maintenance.	4
4	**Drill Bits**	Types of bits, standard classification of bits, bit selection methods	5
5	**Drilling Mud Engineering**	Introduction, functions, types of mud, fundamental properties of mud, mud circulation, mud conditioning system.	5
6	**Casing & Cementing**	Casing, functions, types, casing sequence, cementing, functions of cement, cement classes, casing accessories, setting casing, single stage and two stage cementing.	6
7	**Borehole Problems**	Introduction, pipe sticking differential sticking, mechanical sticking, and key seating; sloughing shale, lost circulation zones.	6
Total			**37**

4. Readings

4.1 Suggested Books:

1. Oil well Drilling Engineering, H Rabia
2. Well Construction and Engineering, H. Rabia
3. Composition and Properties of Drilling and Completion Fluid, H.C.H Darley and George R. Grey
4. Drilling Engineering- A complete Well Planning Approach, Neal J. Adams
5. Drilling Operation Practices Manual, IDT, ONGC

5. Outcome of the Course:

1) The drilling concepts of a well from planning to rig mobilization to the location.
2) The concept of a drill string design for drilling.
3) The suitable drilling fluids during drilling.
4) The concept of Casing and Cementation installation.
                              5) To troubleshoot well borehole problems.

Unit Operations-I

1.1 Course Number- CE201
1.2 Contact Hours- 3-1-0   Credits: 11
1.3 Semester Offered- 2nd Year Odd
1.4 Prerequisite: NA
1.5 Syllabus Committee members- Dr. Abhimanyu Kar, Dr. Sanat Kumar Singha, Dr Naveen Mani Tripathi, Dr. Karthik Babu NB

2. Objective:

i) To study statics, kinematics and dynamics of fluids.
ii) To understand the characteristics associated with the fluid flow though pipeline systems.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Fluid Statics**	Brief description of various fluid properties, Pressure at a point, Compressible and Incompressible fluid, Measurement of pressure, Manometry, Buoyancy, Archimedes' principle and stability	6
2	**Fluid Kinematics**	Classification of fluid flows – viscous vs inviscid flow, internal vs external flow, compressible vs incompressible flow, laminar vs turbulent flow, natural vs forced flow, steady vs unsteady flow, uniform vs non-uniform flow; Flow patterns – timeline, streamline, path line, streamline	9
3	**Fluid Dynamics**	Fluid flow rate, Conservation of mass, Continuity equation, The Bernoulli's equation and its application	9
4	**Pipe Flow**	Flow regimes in a pipe, Energy loss in pipes through Darcy-Weisbach equation and Hagen-Poiseuille equation, Friction factor, Turbulent flow in pipes, Moody's Diagram	9
5	**Pipeline Systems**	Basic of pipe network system, Minor losses in pipes, Energy and hydraulic grade line, Valves used in pipelines – Flow control valve, Check valve, Pressure relief valve/ Safety valves	6
	Total		**39**

4. Readings

4.1 Textbooks/ Reference Books:

1) Elger, Donald F., Barbara A. LeBret, Clayton T. Crowe, and John A. Roberson. Engineering fluid mechanics. John Wiley & Sons, 2020.
2) Yunus, A. Cengel. Fluid Mechanics: Fundamentals and Applications (SI Units). Tata McGraw Hill Education Private Limited, 2010.
3) Fox, Robert W., Alan T. McDonald, and John W. Mitchell. Fox and McDonald's introduction to fluid mechanics. John Wiley & Sons, 2020.
4) R.K. Bansal, A textbook of Fluid Mechanics and Hydraulic Machines, Laxmi Publications.

5. Outcome of the Course:

1) Knowledge of fluid properties, stress, buoyancy and floatation.
2) Classify fluid flow and flow pattern.
3) Understand continuity and Bernoulli equations.
4) Derive Darcy-Weisbach equation and Hagen-Poiseuille equation associated with pipe flow.
5) Calculate friction factor from Moody diagram.
6) Knowledge of minor & major losses and energy & hydraulic grade lines corresponding to pipe flow.
7) Classify flow control valves and safety valves.

Engineering Thermodynamics

1.1 Course Number- ME206

1.2 Contact Hours- 3-0-0   Credits: 9

1.3 Semester Offered- 2nd Year Odd

1.4 Prerequisite: NA

1.5 Syllabus Committee members- Dr. Abhimanyu Kar, Dr. Sanat Kumar Singha,
Dr Naveen Mani Tripathi, Dr. Karthik Babu NB

2. Objective:

i) To understand basic concept of thermodynamics and its properties.

ii) To generate the ability to differentiate different forms of energy i.e., heat and work.

iii) To apply first law of thermodynamics to closed and flow systems.

iv) To realize the need of second law of thermodynamics, spontaneity and irreversibility in nature.

v) To learn basic concepts of real gases and working of external and internal combustion engines.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Basic concepts and definition**	Scope and limitations of Thermodynamics, Macroscopic and Microscopic approaches; Definition of System, Surrounding, closed systems, and open system; Properties: (extensive and Intensive), Characteristics of properties (point and path function), and its representation on a property diagram; Units of measurements: Force, Pressure, and Energy.	6
2	**Equilibrium and Zeroth Law**	Equilibrium: Thermal, Mechanical, Chemical, Thermodynamic; Zeroth Law of Thermodynamics and temperature, Measurement of temperature and calibration of Thermometers, the ideal gas temperature scale.	5
3	**Processes and its representation**	Reversible and Irreversible processes; Different types of process and their representations.	2
4	**Work and Heat Transfer**	Definitions and calculations: Work Transfer, Different modes of work, Displacement Work for various processes, Heat Transfer, Specific heat, Latent heat.	4
5	**First Law of Thermodynamics**	Joule's experiment, Introduction of internal energy as a thermodynamics property, Introduction of enthalpy as a thermodynamic property; Definition of specific heats and their use in calculation of internal energy and enthalpy with emphasis on ideal gases.	5
6	**Applications of First Law of**	Application of First Law to control mass: Work done and heat transfer in various types of elementary processes;	8

	Thermodynamics	Application of First Law to control volumes; Nozzle, Diffuser, Compressor, Turbine, Throttling device, Heat Exchanger. (Only steady flow need be considered).	
7	**Second Law of Thermodynamics**	Limitations of first law of thermodynamics; Cyclic heat engine; Energy reservoirs; Refrigerator and Heat Pump; Kelvin-Plank statement and Clausius statement of second law; Reversibility and Irreversibility; Carnot Cycle and Carnot Theorems;	5
8	**Entropy**	Clausius' Theorem and Clausius' inequality; Concept of entropy; Entropy and Disorder; Entropy changes in various processes, Entropy Principle and its application,	5
		Total	**40**

4. Readings

4.1 Textbooks:

1. Engineering Thermodynamics by P.K. Nag, Publisher: TMH
2. Basic Engineering Thermodynamics by Rayner Joel, Pearson Education

4.2 Reference Books:

1. Engineering Thermodynamics by Van Wylen and Sontang, John Wiley
2. Engineering Thermodynamics by M. Achuthan, Publisher: PHI
3. Applied Thermodynamics by Eastop and McConkey, Publisher: Pearson
4. Fundamental of Engineering Thermodynamics by E. Rathakrishnan, publisher. PHI
5. Engineering Thermodynamics by Russel and Adebiyi, publisher, Oxford
6. Steam Tables in SI Units by Ramalingam, Scitech.

5. Outcome of the Course:

1) Basic understanding thermodynamics and its applications
2) Understand the basics of Engineering Materials (its applications) and Stress-Strain
3) Basic understanding of boilers, engines and latest automobile technologies.
4) Understand the basics Applied Mechanics, Simple lifting Machines & Power Transmission
5) Understand the basics of Engineering surveying and Smart Infrastructure Development.

Unit Operations Laboratory – I

1.1 Course Number: CE201L

1.2 Contact Hours: 0-0-2   Credits: 2

1.3 Semester-offered: 2nd Year –Odd

1.4 Prerequisite: Diploma level Mathematics and Physics

1.5 Syllabus Committee Members: Dr. Bhaskar Jyoti Medhi, Dr. Anil Kumar Varma, Dr. Arun Kumar

2. Objective:

i) The lab is to provide practical and theoretical experience in a number of important chemical engineering unit operations ensuring a thorough understanding of the principles of unit operation. The course includes experimental execution, data analysis and error analysis, skills development in oral presentation, technical report writing, and team-building.

ii) The experiments are designed to illustrate the principles of fluid and particle mechanics, separation processes.

3. Course Content:

Sl. No.	List of Experiments
1	To verify the Bernoulli's equation
2	To study the head losses due to various fittings in pipeline
3	To study different types of flow
4	To measure the viscosity of oil using Redwood Viscometer
5	To measure the discharge through Venturi meter, Orifice meter and Rotameter
6	To study the Reciprocating pump characteristics
7	To study the Centrifugal pump characteristics
8	To study the operation of ball mill
9	To study the operation of gyratory sieve shaker
10	To study the working principle of froth flotation cell
11	To study the operation of plate and frame filter press

4. Outcome of the Laboratory:

This lab will give the student a thorough knowledge of fluid and particle mechanics, separation processes. Understand to analyze experimental data and observed phenomena to write good technical report.

Geology Laboratory

1.1 Course Number: PE201L
1.2 Contact Hours: 0-0-2   Credits:2
1.3 Semester-offered: 2nd Year–Odd
1.4 Prerequisite: Fundamentals of Geology
1.5 Syllabus Committee Members: Dr. Satyajit Chowdhury, Dr. Chinmoy Jit Sarma, Dr. Sekhar Gogoi & Dr. Srawanti Medhi

List of Practicals:

1. Study different Physical Properties of Minerals.
2. Identification of minerals on the basis of their physical properties.

3. Study and identification of different types of Rocks. (Igneous, sedimentary & metamorphic rocks).
4. Study and sketching of various types of faults (normal, reverse, dip, shake, nonplunging and plunging faults.
5. Study and sketching of various types of structure folds (anticline, syncline, symmetrical & asymmetrical.
6. Determination of Dip and Strike of geological structures with a Clinometer Compass.
7. Geological cross sections and study of geological maps

Semester IV

Reservoir Engineering-II

1.1 Course Number: PE206
1.2 Contact Hours: 3-1-0   Credits:11
1.3 Semester-offered: 2nd Year –Even
1.4 Prerequisite: NA
1.5 Syllabus Committee Members: Dr. Chinmoy Jit Sarma, Dr. Satyajit Chowdhury,
     Dr. Sekhar Gogoi & Dr. Srawanti Medhi

2. Objective:

i) To help the students understand the fundamentals and relevance of reservoir engineering in the broader context of Oil/Gas Field Exploitation, and   have in-depth knowledge of vital aspects of elements of reservoir engineering in particular

ii) To enable students to understand fluid properties existing in hydrocarbon reservoir and apply laws of fluid flow through porous media and their applicability under various field conditions.

iii) To empower students with the resource analysis expertise through extensive evaluation of hydrocarbon reservoir with respect to reserve estimations, recovery factors and ensure a positive economic gain.

iv) To enable students to emulate and simulate the reservoir parameters and use the same in futuristic R&D of their respective research areas and concerns in and around fluid mechanics such as energy, health etc. across multidisciplinary domains.

v) To equip students with multidisciplinary approach of problem-solving professional way by using commercial software packages, data analysis and presentation, numerical simulations etc.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Introduction**	Overview of applied reservoir engineering and reservoir management.	5
2	**Performance analysis**	Performance prediction of depletion drive, gas cap drive, water drive and combination drive.	5
3	**Water influx**	Water influx: steady and unsteady state models.	5
4	**Water and gas injection**	Reservoir pressure maintenance techniques, their advantages and limitations.	4
5	**Theory of fluid-fluid displacement**	Immiscible Displacement processes: Theory & practices-Buckley Leverette treatment of fractional flow and frontal advance equations, water flood performance.	6

6	**Enhanced Oil Recovery**	Introduction, Improved Oil Recovery: Conventional IOR and EOR, Primary and IOR chart; Primary recovery, Pressure declines after primary recovery, Secondary recovery, Factors causing High residual oil Saturation, EOR/Tertiary Recovery, Viscous fingering, Economic value of different EOR techniques, Chemical EOR, Miscible EOR, Thermal EOR, Microbial EOR	7
7	**Well Testing**	Role of oil well tests, oil well test types- periodic production test, productivity test (bean study), pressure transient tests; indicator diagram study: procedure and parameters obtained, Buildup test and drawdown test, gas well test, type curve, Drill stem testing, wireline formation tests, multiple well tests- interference well test and pulse test, Injectivity and fall off tests	6
Total			38

4. Readings

4.1 Textbooks:

1. Tarek Ahmed, "Reservoir Engineering Handbook", Gulf Professional Publishing, 4th ed, (2010).
2. NnaemekaEzekwe, "Petroleum Reservoir Engineering Practice", Pearson Education, Inc, (2010).

4.2 Reference Books:

1. Benjamin Cole Craft, Murray Free Hawkins, and Ronald E. Terry, "Applied Petroleum Reservoir Engineering" by Prentice Hall, (1991).
2. LP Dake, "Fundamentals of Reservoir Engineering" shell learning and development, (1998).
3. Tarek Ahmed, Paul D. McKinney, "Advanced Reservoir Engineering" Gulf Professional Publishing, 4th ed, (2005).
4. BF Towler, "Fundamental Principles of Reservoir Engineering", SPE, (2002).
5. Heriot Watt, "Reservoir Engineering Handbook".
6. Abhijit Y. Dandekar, "Petroleum Reservoir Rock and Fluid Properties", CRC Press, (2013).

5. Outcome of the Course:

1) Gain the knowledge of reservoir properties of rocks
2) Calculate the properties of reservoir fluid.
3) Gain insight into vapor – liquid, liquid – solid phase equilibrium during oil & gas production.
4) Understand the phenomenon of multiphase flow system in porous media and Equations for the calculation of required parameters applied in Reservoir Engineering.
5) Understand and explain different drive mechanisms and recovery factor of a Reservoir.
6) Calculate reserves of oil and gas by volumetric and material balance and acquire the Basics knowledge of Reservoir Modeling Software's

Basics of Petroleum Refinery

1.1 Course Number: PE207

1.2 Contact Hours: 3-0-0   Credits: 9

1.3 Semester- offered: 2nd Year –Even

1.4 Prerequisite: Diploma level Chemistry and Unit Operations I

1.5 Syllabus Committee Members: Dr. Chinmoy Jit Sarma, Dr. Satyajit Chowdhury,
    Dr. Sekhar Gogoi & Dr. Srawanti Medhi

2. Objective:

Petroleum sector plays the most vital role for keeping the wheels of economic development rolling and chemical engineers mainly run the petroleum industry. Knowing the sources of crude petroleum, extraction of the crude petroleum, its refining to the useful Petro-products and efficient transport to the end users through network are important tasks to the petroleum or chemical engineers. This course intends to form the foundation of the chemical engineers on all the above-mentioned basic fields of petroleum from extraction to the safe end use where refining is the most challenging. The course puts major thrust on all the techniques/processes of petroleum refining encompassing selection of the mass/heat transfer devices, their operation and basic design. The course also covers the feed stocks of petrochemical industries and manufacture important petrochemicals.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topic	Sub-Topics	Lectures
1	**Introduction to Petroleum Industry**	Overview of Indian petroleum industry, Crude oil: Origin, Composition, Characteristics; Exploration Methods, Search for crude oil, Scientific methods for petroleum survey, Introduction to rigs.	6
2	**Quality Control of Petroleum Products**	Classification of laboratory tests: Distillation, Vapour pressure, Flash and Fire points, Octane number, Performance number, Cetane number, Aniline point, Viscosity index, Calorific value, Smoke point, Char value, Viscosity, Viscosity index, Penetration test, Cloud and Pour points, Drop point of grease, Melting and Settling points of wax, Softening point of Bitumen, Induction period of gasoline, Thermal stability of jet fuels, gum content, Total Sulphur, Acidity and Alkalinity, Copper Strip Corrosion Test, Silver-Strip Corrosion Test for ATF, Ash, Carbon Residue (Conradson method, Ramsbottom method), Colour, Density and Specific gravity.	6
3	**Petroleum Products**	Composition, Properties & Specification of LPG, Naphthas, Motor spirit, Kerosine, Aviation Turbine Fuels, Diesel Fuels, Fuel Oils.	6
4	**Crude Oil Distillation, Thermal and Catalytic Conversion**	Desalting of crude oils, Atmospheric distillation of crude oil, Vacuum distillation of atmospheric residue. Products of fractional distillation of crude oil and their boiling ranges. Thermal Cracking Reactions, Thermal Cracking, Visbreaking (Conventional Visbreaking and Soaker	10

	Process	Visbreaking), Coking (Delayed Coking, Fluid Coking, Flexicoking), Fluid catalytic cracking; Comparison between thermal and Catalytic cracking, Hydrocracking, Hydrotreating, Reforming, Isomerization, Alkylation: Hydrofluoric acid process, Sulphuric acid process; Polymerization.	
5	**Introduction of Petrochemical Industry**	Definition, History, Raw materials for petrochemicals, Characteristics of petrochemical Industry, Major petrochemical producers in India, different petrochemical products and their uses.	6
6	**Safety in Hydrocarbon Industry**	Introduction, Crude oil Pretreating, Distillation, Thermal Cracking, FCC (Fluidized Catalytic cracking), Hydro Cracking, Catalytic Reforming, Hydro Desulfurization, Hydrogen sulfide safety, Isomerization, Polymerization Alkylation, Sweetening and Treating process	6
		TOTAL	**40**

4. Readings:

4.1 Textbooks:

1. W.L. Nelson, Petroleum Refinery Engineering, McGraw Hill, New York.
2. B.K. B Rao, Modern *Petroleum Refining* Processes, Oxford & IBH *Publishing.*

4.2 Reference Books:

1. B.K. B Rao, A Text on Petrochemicals, Khanna Publishers.
2. S. Maity, Introduction to Petrochemicals, Oxford and IBH Publishing.

5. Outcome of the Course:

On completion of this course, students will be able to

1) Understand the worldwide scenario of petroleum refinery, growth prospects, origin of crude oil, their characteristics and future trends.
2) Demonstrate the comprehensive understanding of classification, properties and uses of various refinery products.
3) Develop the knowledge of different refining operations like pretreatment of crude oil, atmospheric and vacuum distillation, cracking operations.
4) Study of different advance processing techniques like hydro cracking, Vis breaking, isomerization, polymerization along with process flow sheet and descriptions.
5) Identify and suggest safe practices in operations of refineries and petrochemical complexes.

Drilling Engineering-II

1.1 Course Number: PE208
1.2 Contact Hours: 3-1-0   Credits:11
1.3 Semester-offered: 2nd Year –Even
1.4 Prerequisite: NA
1.5 Syllabus Committee Members: Dr. Chinmoy Jit Sarma, Dr. Satyajit Chowdhury,
    Dr. Sekhar Gogoi & Dr. Srawanti Medhi

2. Objective:

i) To help the students understand the risks in well construction.
ii) To enable students to understand the well design procedure.
iii) To enable students to understand the types of directional drilling techniques.
iv) To empower students with the expertise of understanding different procedures of well control.
v) To equip students with necessary engineering skills such as solving engineering problems in a professional way.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Straight hole drilling**	Causes of hole deviation, mechanical factors, crooked-hole tendency, Bottom hole assembly: Slick BHA, Pendulum BHA, packed hole BHA; stabilizers and reamers	12
2	**Directional hole drilling**	Well geometry, types, directional BHAs, surveying tools, Well path deflection & correction. deflection tools- bent-sub, whipstock, jet bit downhole motors – turbine and positive displacement mud motor, dog leg severity, Horizontal well	14
3	**Basics of well control**	Introduction to Well Control, Overburden stress, hydrostatic pressure, fracture pressure, fracture gradient – leak off test, casing seat selection, Causes of Kicks, Kick Warning Signs and Kick Indicators, Prevention of kick, Well Control Methods	11
4	**Well control and well killing methods**	Well Control Equipment: Blowout Preventers (BOPs) and its types, Choke Manifolds and Chokes, BOP Control Systems, well killing procedure, kill mud, killing methods: wait and wait method, driller's method.	10
	Total		**47**

4. Readings

4.1 Suggested Books:

1. Directional and Horizontal Drilling, J.A. Short, PennWell Publishing
2. Oil well Drilling Engineering, H Rabia, Gulf Publishing
3. Blowout and Well Control Handbook, Robert D. Grace, Gulf Professional Publishing
4. Advanced Drilling Engineering, G. Robello Samuel, Xiushan Liu; Gulf Publishing
5. Drilling Engineering Workbook, Baker Hughes INTEQ
6. Drilling Operation Practices Manual, Institute of Drilling Technology, ONGC
7. Drilling Engineering, Heriot Watt University

5. Outcome of the Course:

On completion of this course, the students will be able to

1) Understanding of different drilling rig components and drilling systems.
2) Evaluate the different types of muds, drilling systems and Bits and Drill String.
3) Evaluate the application of Casing and Cementing Operation.
4) Analyze the importance of Directional Drilling and designing of any drilling process before operating it.
5) Examine the various methods of well control and different well control Equipment's.
6) Examine the various instruments that come under well completion and methods of Drilling fluids disposal methods.

Production Engineering-II

1.1 Course Number: PE209
1.2 Contact Hours: 3-0-0   Credits:9
1.3 Semester-offered: 2nd Year –Even
1.4 Prerequisite: NA
1.5 Syllabus Committee Members: Dr. Chinmoy Jit Sarma, Dr. Satyajit Chowdhury,
    Dr. Sekhar Gogoi & Dr. Srawanti Medhi

2. Objective:

The objective of this course is to help participants gain an understanding of oil & gas surface installation systems. The course introduces the various separation processes utilized in separating three phases of recovered crude. i.e., oil, water and gas. It also introduces about the different treatment techniques employed in the treatment of crude oil and also of produced water before being injected/discharged into the well/environment.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Introduction**	Surface Operation: Separator and storage, Typical flowsheet in a production facility, Common flow sheet symbols, well to sales flow, Stage Separation, Process controls, Safety symbols, Group Gathering Station (GGS)	6
2	**Two Phase liquid & gas separation**	Introduction, Factors affecting separation, Separators: components, types, operating problems.	6
3	**Oil & water separation**	Introduction, three phase separation, water washing, oil pad, separator types: Horizontal and vertical separators: Weir design and bucket and weir design	6
4	**Crude Oil Treating System**	Emulsion: Emulsifiers and de-emulsifiers, De-emulsification & Dehydration process, Types of Treating equipment: vertical, horizontal and electrostatic treaters.	6
5	**Storage**	Introduction, Categories of storage tank system: Onshore: Above ground and underground system, and offshore storages, Tank maintenance and Tank Gauging.	6
6	**Produced Water treating system**	Theory, Treatment types and equipment: Primary, Secondary and tertiary systems.	6
Total			**36**

4. Readings

4.1 Reference Books:

1. Surface Production Operations, Volume 1, Ken Arnold & Maurice Stewart, Gulf Publishing, Houston, Texas, USA
2. Petroleum Production Engineering, Boyun Guo, William C. Lyons & Ali Ghalambor, Elsevier Science & Technology Books
3. Introduction to Petroleum Production: Volume 3: Well site facilities, Water Handling, Storage, Instrumentation and Control System, D. R. Skinner, Gulf Publishing Company

5. Outcome of the Course:

The students will be able to:

1) Get to know about the surface equipments installations at oil and gas locations
2) Understand various operations involved in separation of crude oil, gas and water phases
3) Get acquainted to crude oil and water treating systems

Health, Safety and Environment Management

1.1 Course Number: PE210
1.2 Contact Hours: 3-0-0   Credits:9
1.3 Semester-offered: 2nd Year – Even
1.4 Prerequisite: NA
1.5 Syllabus Committee Members: Dr. Satyajit Chowdhury, Dr. Chinmoy Jit Sarma, Dr. Sekhar Gogoi
     & Dr. Srawanti Medhi

2. Objective:

i) To create the awareness among students regarding importance of safety in industries.
ii) To introduce the definitions, concepts, methodologies used in management of occupational safety in industries.
iii) Students will be able to recognize and evaluate occupational safety and health hazards in the workplace, and to determine appropriate hazard controls following the hierarchy of controls.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Safety - Need for safety- HSE policy Definitions**	Health, Safety, Accident, Near Miss, Lost Time Injury, Unsafe act, Unsafe Condition, Dangerous Occurrence, Reportable accidents. History of safety movement- Causes of Accident- Safety education & training – Importance, Various training methods, Effectiveness of training.	5
2	**FIRE**	Definition of Fire, Fire Triangle, Tetrahedron of Fire, Classification of fires, Types of Extinguishing Media, Principles of Fire Extinguishing Methods Cooling, Starvation, Smothering, Retarding Chain Reaction, Stages of Fire, various Products of combustion, ignition sources.	5
3	**Active & passive fire protection system**	Overview of suppression and extinguishment, Suppression agents, Portable Fire Extinguishers-Classifications of portable fire extinguishers. Water based suppression system, Foam based Suppression system, Carbon Dioxide based Suppression system, Dry & Wet Chemical based Suppression system. Overview of Fire Fighting Equipments.	8
4	**Hazard**	Classification of Hazards-Risk Control Hierarchy- Risk Assessment- HIRA- Process Safety Management-Elements of PSM. Job Safety Analysis- Plant Inspection- Safety Audit- Near Miss Reporting – Accident investigation.	6

5	**Work permit system**	Objectives, hot work and cold work permits. Entry to Confined space- Confined Space permits. Working at height & Scaffolding hazards. Electrical hazards- Electrical Permit-LOTO. Personal Protective equipments.	6
6	**Occupational Health monitoring system. Environmental impacts of various industrial operations**	EIA. Case studies of various major Industrial accidents. OISD 105, OISD 115, 116, OISD 117, OISD-166.	6
	Total		**36**

4. Readings

4.1 Textbooks:

1. Sesha, P., Manual of Fire Safety
2. A. *Maurice* Jones, Fire Protection System- Third Edition,2021
3. RK Jain and Sunil S Rao- Industrial Safety, Health and environment Management system.

4.2 Reference Books:

1. Petroleum act,1934 & Petroleum Rules, 2002, PESO
2. OISD-115 (Oil Industry Safety Directorate), (2002). Guidelines on Fire Fighting Equipment and Appliances in Petroleum Industry. <http://www.oisd.nic.in/oisd-std-115>.
3. OISD-116 (Oil Industry Safety Directorate), (2017). Fire Protection Facilities for Petroleum Refineries and Oil/Gas Processing Plants. <http://www.oisd.nic.in/oisd-std-116>.
4. OISD-117 (Oil Industry Safety Directorate), (2017). Fire Protection Facilities for Petroleum Depots, Terminals, Pipeline Installations & Lube oil installations. <http://www.oisd.nic.in/oisd-std-117>.
5. OISD-105 (Oil Industry Safety Directorate), Work Permit System.

5. Outcome of the Course:

On completion of this course, students will be able to-

1) Demonstrate the knowledge and understanding of basic terms in safety management.
2) Understand safety organizational requirements for effective safety management.
3) Evaluate the workplace hazards and apply controls measures using hierarchy of control.

Drilling Fluid and Cementation Laboratory

1.1 Course Number: PE204L
1.2 Contact Hours: 0-0-2   Credits:2
1.3 Semester-offered: 2nd Year–Even
1.4 Prerequisite: Fundamentals of Drilling Engineering and Fluid Mechanics
1.5 Syllabus Committee Members: Dr. Satyajit Chowdhury, Dr. Chinmoy Jit Sarma, Dr. Sekhar Gogoi & Dr. Srawanti Medhi

List of Experiments:

1. Formulation of polymer and bentonite-based drilling fluid
2. Measuring density and specific gravity of drilling fluid.
3. Determining rheology of drilling fluid (Viscosity, Gel strength, and Yield point) at low and high temperatures
4. Determination of fluid loss of a given drilling fluid using API filter press at LPLT condition.
5. Measurement of oil, water, solid and clay content of a drilling fluid.
6. Determining setting point and consistency of cement slurry.
7. Measurement of pH, salinity, and conductivity of mud
8. Measurement of viscosity of drilling fluid using Marsh Funnel Viscometer
9. Measurement of sand content in mud using sand content kit.

Reservoir Engineering Laboratory

1.1 Course Number: PE202L
1.2 Contact Hours: 0-0-2   Credits:2
1.3 Semester-offered: 2nd Year–Even
1.4 Prerequisite: Fundamentals of Reservoir and Enhanced oil Recovery processes.
1.5 Syllabus Committee Members: Dr. Satyajit Chowdhury, Dr. Chinmoy Jit Sarma, Dr. Sekhar Gogoi & Dr. Srawanti Medhi

List of Experiments:

1. Determination of effective porosity by Saturation method.
2. Measurement of surface tension & interfacial tension with a Tensiometer.
3. Determination of wettability by Amott cell
4. Measurement of absolute permeability using liquid permeameter.
5. Measurement of absolute permeability using Air permeameter
6. Cutting, plugging, trimming/end facing of core samples.
7. Core cleaning using Soxhlet apparatus.
8. Determination of capillary pressure of a core sample
9. Determination of resistivity of a core sample

Semester V

Workover and Well Stimulation

1.1 Course Number: PE301
1.2 Contact Hours: 3-1-0   Credits:11
1.3 Semester-offered: 3rd Year –Odd
1.4 Prerequisite: NA
1.5 Syllabus Committee Members: Dr. Chinmoy Jit Sarma, Dr. Satyajit Chowdhury,
   Dr. Sekhar Gogoi & Dr. Srawanti Medhi

2. Objective:

The objective of this subject is to introduce students to the services division of the oil and gas industry in terms of work-over jobs and well stimulation. It will briefly discuss reservoir associated problems and well completion problems. It will deal with well servicing operations like removal of hydrates, wax, scales, fishing operations. It shall also explain cementing failures and the remedial operations. The subject will also explain stimulation methods of acid treatment and hydraulic fracturing jobs.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Well problems**	Introduction, Source of well problems, Reservoir associated problems, Mechanical failures in a wellbore and well completion associated problems, coning, introduction to workover and stimulation	8
2	**Hydrate, wax and scales**	Hydrate: conditions for hydrate formation, hydrate inhibition; Wax/paraffin: causes of wax deposition, remedial measures, preventive measures; Scales: deposition, causes, scale removal methods, scale prevention	8
3	**Remedial cementing**	Cementing failures, squeeze cement injection and cement action, squeeze cementing techniques: bradenhead method, packer squeeze method, hesitation squeeze, Cement plugs, plug operations: balanced plug and dump bailer method	8
4	**Fishing operations**	Introduction, types of fish; junk; fishing tools: catching/grabbing tools and breaking tools; junk shots; scrappers and drilling jars; planning and preparation for fishing operations, fishing challenges	8
5	**Well Stimulation: Acidization treatment**	Introduction to well stimulation, reasons for performing stimulation, methods of well stimulation, acidization, matrix acidization: working, types of acids for carbonate and sandstone reservoirs, placement technique of acid job, purpose, fracture acidizing process, fracture pressure	8

6	**Well Stimulation: Hydraulic formation fracturing**	Introduction, reasons and purpose, components required in a hydraulic fracturing site, fracturing fluid and its components, Types of fracture fluids, proppants, hydraulic well fracturing process	8
Total			**48**

4. Readings

4.1 Suggested Books:

1. Introduction to Petroleum Production, Vol I, D.R. Skinner, Gulf Publishing Company
2. Petroleum production engineering; BoyunGuo, William C.Lyons, Ali Ghalambor; Gulf Professional Publishing
3. Petroleum Engineering Handbook, Volume IV: Production Operation Engineering, Joe Dunn Clegg, SPE books
4. Petroleum Production Systems, Michael J. Economides, A. Daniel Hill, Christine Ehlig-Economides, Ding Zhu; Prentice Hall Production Technology I, Heriott-Watt University

5. Outcome of the Course:

The students will be:

1) Gaining knowledge about different well services.
2) Understanding the importance of maintenance and remedial operations to keep the well in good production condition.
3) Knowing about simulation services of acidization and hydraulic fracturing.

Petroleum Formation Evaluation

1.1 Course Number: PE302
1.2 Contact Hours: 3-1-0   Credits:11
1.3 Semester-offered: 3rd Year –Odd
1.4 Prerequisite: NA
1.5 Syllabus Committee Members: Dr. Chinmoy Jit Sarma, Dr. Satyajit Chowdhury,
     Dr. Sekhar Gogoi & Dr. Srawanti Medhi

2. Objective:

The objective of this course is to help participants attain a comprehensive knowledge of the fundamental principles involved in evaluation of subsurface formation to identify its characteristics, the various technologies utilized to measure subsurface properties. This will help in evaluating the usability and values of subsurface rock formations for crude oil and gas accumulation and its production.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Introduction**	Introduction to formation evaluation, logging objectives, log run-log chart, classification: non-wireline logs and wireline logs, procedure of logging, , wireline logging, and production logging techniques	7
2	**Non-Wireline logs**	Mud log, tools utilized in mud logging; Core sample, types of coring: conventional and sidewall coring, core analysis, drilling operation logs: measurement while drilling, logging while drilling	8
3	**Resistivity Log & SP Log**	Resistivity Log: Introduction, resistivity logs, micro-resistivity logs, induction log, log presentation, Archie's laws; SP Log: Introduction, electrochemical potential, electro-kinetic potential, total potential, SP tool, log presentation	8
5	**Gamma Ray Log**	Natural Radioactivity, gamma ray, gamma ray detector, Log presentation, shale content, well log trend patterns	6
5	**Density & Neutron Logs & Acoustic Log**	Density & Neutron Logs: Density Logging tool & technique, bulk density and porosity measurement, log presentation; Neutron interaction, neutron tool, log interpretation, gas anomaly, uses; Acoustic (Sonic) Log: Introduction, sonic logging tools, Wyllie equation, log presentation, uses	7

6	**Caliper & Temperature Logs**	Caliper Logs: introduction, caliper tool, log presentation, interpretation, uses of caliper log; Temperature Logs: introduction, geothermal gradient, borehole temperature measurement, temperature logs with increased time, gas anomaly and fracture detection, uses.	5
7	**Cement quality and Production Logging**	Cement bond, Cementing technique efficiency, quality of cement, bond index, applications; introduction to production Logging, purpose, production logging tools, drill stem test, uses of production logging	6
Total			**48**

4. Readings

4.1 Suggested Books:

1. Fundamentals of Well-Log Interpretation 1. The Acquisition of logging data, O.Serra,Elsevier Science Publishers B.V.
2. Formation Evaluation, Heriot Watt University
3. Open-Hole Log Analysis and Formation Evaluation, Richard M. Bateman, Springer Netherlands
4. The Geological Interpretation of Well Logs, Malcom Rider, Whittles Publishing Services

5. Outcome of the Course:

The students will be able to:

1) Understand the need for evaluation of petroleum formation
2) Know non-wireline as well as wireline method
3) Gain the basics of well logging techniques used in the oil & gas Sector.

Offshore Oil and Gas Operations

1.1 Course Number: PE303
1.2 Contact Hours: 3-0-0   Credits:9
1.3 Semester-offered: 3rd Year - Odd
1.4 Prerequisite: NA
1.5 Syllabus Committee Members: Dr. Chinmoy Jit Sarma, Dr. Satyajit Chowdhury,
    Dr. Sekhar Gogoi & Dr. Srawanti Medhi

2. Objective:

The objective of this course is to help participants attain a basic knowledge of the offshore operations of the oil & gas industry. The course will discuss offshore drilling and production operations. It will discuss different infrastructures applied in offshore locations for activities such as offshore drilling rigs, offshore production platforms, sub-sea wells systems as well as support infrastructure.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Meteorology & oceanography**	Introduction, weather and climate, elements of weather, wind circulation, storms, ocean environment, branches, origin of ocean, oceanic ridge, ocean physiography	4
2	**Offshore Drilling Rigs**	Introduction, types of offshore rigs: bottom supported rigs- submersible drilling pontoons, self-elevating Jack up rigs. Floating rigs: Degree of freedom in rig motion, Semi-submersible rigs, drill ships, mooring and dynamic positioning, drilling: preliminary drilling operations, subsea BOP, marine riser	7
3	**Offshore Production Systems**	Introductions, common elements, types- Fixed: Compliant towers, Gravity platforms; Floating: Tension Leg Platforms (TLP), Floating production storage and offloading (FPSO) system, Spar, system for handling oil	6
4	**Subsea System**	Introduction, Subsea components: wells, subsea trees, manifolds & sleds, flowlines & jumpers, umbilical & flying lead, control systems, heat retention in flowlines.	5
5	**Topsides**	Introduction, different topside facilities, categories of topsides, metering and custody transfer, personnel transportation & their accommodation, safety systems, auxiliary systems.	4
6	**Offshore pipeline laying & risers**	Offshore operations flow path, S lay, J-lay, reel lay, coating & corrosion protection, bottom conditions & burial; Risers: attached risers, pull tubes, steel catenary risers, top tensioned risers, riser tower, flexible risers.	6

7	**Offshore support vessels**	Introduction, platform supply vessels, anchor handling vessels, crew boats, heavy lift vessels, specialty vessels, remotely operated vessels (ROVs)	4
	Total		**36**

4. Readings

4.1 Textbooks:

1. Deepwater Petroleum: Exploration & Production – a nontechnical guide, William L. Leffler, Richard Pattarozi, Gordon Sterling; PennWell
2. Offshore Petroleum Drilling and Production, Sukumar Laik, CRC Press, Taylor and Francis
3. Handbook of Offshore Oil and Gas Operations, James G.Spheight, Gulf Professional Publishing
4. Handbook of Offshore Engineering, Vol I, V Subrata K.Chakrabarti, Elsevier, The Netherlands
5. Handbook of Offshore Engineering, Vol II, V Subrata K.Chakrabarti, Elsevier, The Netherlands

5. Outcome of the Course:

The students will be able to:
1) Understand the necessity of the offshore oil and gas industry.
2) Get an idea of the various infrastructure, operations & supports involved in offshore activities.
3) Compare the offshore with onshore technology.

Humanities

1.1 Course Number: HU301
1.2 Contact Hours: 2-0-0   Credits:6
1.3 Semester-offered: 3rd Year –Odd
1.4 Prerequisite: Diploma level English
1.5 Syllabus Committee Members: DUGC

2. Objective:

i) Foster intellectual curiosity, global knowledge, critical thinking, personal responsibility, and ethical and cultural awareness.
ii) Prepare students to use language effectively.
iii) Establish a framework for students to develop an aesthetic appreciation for fine arts.
iv) Prepare students to be responsible citizens, lifelong learners, and world-ready leaders in their chosen fields.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Introduction to Sociology**	Definition of sociology, some sociological concepts: social structure, status, role, norms, values etc. Socialization, and culture and change. Social stratification - various approaches and concept of social mobility. Population and society - Trends of demographic change in India and the world, Human Ecology, Trends of Urbanization in the developing countries and the world. Major social institutions - Family and marriage, caste and tribe and organizations: (i) formal organization (bureaucracy) (ii) informal organization. Processes of social change - Modernization (including Sanskritization), industrialization, environmental/ecological changes and development. Social movements - protest movements, reformist movement and radical movements in India.	9
2	**Introduction to Literature**	Nature of Literature: Literature as a Humanistic Experience. Definitions: (i) Humanities: concern with culture, values, ideologies; (ii) Literature: concepts of imitation, expression, intuition & imagination. Major Themes of Literature: Nature, Science, Selfhood, Love, Rebellion. The Language of Literature: Modes of literary and non-literary expression. The concepts of Figurative language, imagery, symbolism, style. The Forms of Literature:	7

		Prose Narratives (short stories & novels) Poetry, Drama and Essays (Suitable texts are to be chosen by the instructors), Use of a Learner Dictionary.	
3	**Introduction to Philosophy**	Philosophy and History of Science: Growth of scientific knowledge: factors leading to the emergence of modern science. Conceptual evolution: internal and external history. Methodology of science: induction, falsifications, confirmation and probability. Nature of scientific laws and theories: realism, instrumentalism, and under-determination. Relationship between scientific observation, experiment and scientific theory. Nature of scientific explanation: teleological explanations and the covering law model. Selected case studies on scientific theories. Logic and the nature of mathematical reasoning: Inductive and deductive forms of reasoning. Nature of axioms: formal axiomatic systems. Concept of consistency, independence, and completeness. Nature of rules of inference and proof. Selected examples of axiomatic systems and proof procedures. Cognition: Current approaches to the understanding of mind and mental processes: empiricist, rationalist, behaviorist and cognitivist. Ethics: Impact of science and technology on man and society: elements of environmental and professional ethics	7
	Total		23

4. Readings

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4.1 Textbook/Reference Books:

(A) Introduction to Sociology:
    (a) L. Broom, P. Selznick and D. Dorrock, Sociology, 11th Edn. 1990 (Harper International).
    (b) M. Haralambos, Sociology: Themes and Perspectives, Oxford University Press, 980.
    (c) M.S.A. Rao (ed) Social movements in India, vols. 1-2, 1984, Manohar.
    (d) David Mandelbaum, Society in India, 1990, Popular.
    (e) M.N. Srinivas, Social change in modern India, 1991, Orient Longman.
    (f) Guy Rocher, A. General Introduction to Sociology, MacMillan, 1982.
(B) Introduction to Literature:
    (a) David Murdoch (ed.). The Siren's Song: An Anthology of British and American Verse, Orient Longman, 1988.
    (b) S. Alter & W. Dissanayake (eds.) The Penguin Book of Modern Indian Short Stories. Penguin Books (India), 1989.
    (c) Bertrand Russell, Impact of Science on Society. Allen &Unwin, 1952.
    (d) Henrik Ibsen, A Doll's House, Macmillan India, 1982.
    (e) George Orwell, Animal Farm, Penguin, 1951.
    (f) J. Bronowski. The Ascent of Man, BBC, 1973.
(C) Introduction to Philosophy:

(a) A.C. Grayling (ed.) Philosophy: A Guide through the Courses/Subjects, Oxford Univ. Press, London, 1995.
(b) Marx W. Wartofsky, Conceptual Foundations of Scientific Thought: An Introduction to the Philosophy of Science, Macmillan, London, 1968.
(c) I.B. Cohen, The Birth of a New Physics, Vakils, Feffer and Simons Pvt. Ltd., Bombay, 1968.
(d) H. Eves and C.V. Newsom, Foundations and Fundamental Concepts of Mathematics, Boston, PWS-Kart Pub. Co., 1990.
(e) K.E. Goodpaster and K.M. Sayre (eds.) Ethics and Problems of 21st Century, Univ. of Notre Dame Press, London, 1979.
(f) S.D. Agashe, A. Gupta & K. Valicha (eds.) Scientific Method, Science, Technology and Society: A Book of Readings, Univ. of Bombay Press, 1963.

5. Outcome of the Course:

Students will demonstrate:

Knowledge of the conventions and methods of at least one of the humanities in addition to those encompassed by other knowledge areas required by the General Education program.

Engineering Economics

1.1 Course Number: MT301
1.2 Contact Hours: 2-1-0   Credits:8
1.3 Semester-offered: 3rd Year –Odd
1.4 Prerequisite: Diploma level Mathematics
1.5 Syllabus Committee Members: DUGC

2. Objective:

i) To make fundamentally strong base for decision making skills by applying the concepts of economics.
ii) Educate the students on how to systematically evaluate the various cost elements of a typical manufactured product, an engineering project or service, with a view to determining the price offer.
iii) Prepare engineering students to analyze profit/revenue data and carry out make economic analysis in the decision-making process to justify or reject alternatives/projects.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Introduction to Economics**	Introduction to economics – Flow in an economy – Law of supply and demand – Concept of engineering economics – Engineering efficiency – Economic efficiency – Scope of engineering economics – Element of costs – Marginal cost – Marginal revenue – Sunk cost – Opportunity cost – Break-even analysis – V ratio – Elementary economic analysis – Material selection for product design selection for a product – Process planning.	10
2	**Value Engineering**	Make or buy decision – Value engineering – Function – Aims – Value engineering procedure – Interest formulae and their applications –Time value of money – Single payment compound amount factor – Single payment present worth factor – Equal payment series sinking fund factor – Equal payment series payment Present worth factor – Equal payment series capital recovery factor – Uniform gradient series annual equivalent factor – Effective interest rate – Examples all methods.	8
3	**Cash Flow**	Methods of comparison of alternatives – Present worth method (Revenue dominated cash flow diagram) – Future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram) – Annual equivalent method (Revenue dominated cash flow diagram, cost dominated cash flow diagram) – Rate of return method – Examples all methods.	8
Total			**26**

4. Readings

4.1 Textbooks:

1. Panneer Selvam, R., "Engineering Economics", Prentice Hall of India Ltd, 2001.
2. Smith, G.W., "Engineering Economy", Lowa State Press, 1973.

4.2 Reference books:

1. Park, C.S., "Contemporary Engineering Economics", Prentice Hall of India, 2002.
2. Newman, D.G. and Lavelle, J.P., "Engineering Economics and Analysis", Engineering Press, 2002.
3. Degarmo, E.P., Sullivan, W.G. and Canada, J.R, "Engineering Economy", Macmillan, 1984.
4. Grant, E.L., Ireson, W.G. and Leavenworth, R.S., "Principles of Engineering Economy", Ronald Press, 1976.

5.Outcome of the Course:

Upon completing the course, students will be able to:

1) Understand major principles of economic analysis for decision making among alternative courses of action in engineering.
2) Apply economic principles to prices and quantities in competitive supply and demand for goods and for money.
3) Solve economic problems involving comparison and selection of alternatives by using analytical techniques including benefit-cost ratio and breakeven analysis.

Petroleum Product Testing Laboratory

1.1 Course Number: PE307L

1.2 Contact Hours: 0-0-2   Credits:2

1.3 Semester-offered: 3nd Year–Odd

1.4 Prerequisite: Fundamentals of Petroleum Refinery Operations

1.5 Syllabus Committee Members: Dr. Satyajit Chowdhury, Dr. Chinmoy Jit Sarma, Dr. Sekhar Gogoi & Dr. Srawanti Medhi

List of Experiments:

1. To determine the Cloud Point and Pour Point of Crude Oil.

2. To determine the Smoke Point of Crude Oil.

3. To determine the Fire & Flash Point of Crude Oil.

4. To determine the density and viscosity of crude oil.

5. To determine TAN of crude oil.

6. To conduct distillation of crude oil sample using ASTM distillation Apparatus and plot ASTM, TBP and EFV curves.

7. To determine the Softening Point of the given sample.

8. To determine the calorific value of a given sample.

Departmental Elective/ Open Elective

City Gas Distribution

1.1 Course Number: PE304
1.2 Contact Hours: 3-0-0　　　　　Credits:9
1.3 Semester-offered: 3rd Year - Odd
1.4 Prerequisite: NA
1.5 Syllabus Committee Members: Dr. Chinmoy Jit Sarma, Dr. Satyajit Chowdhury,
　　Dr. Sekhar Gogoi & Dr. Srawanti Medhi

2. Objective:

i) To provide a fundamental understanding of the technical and business aspect of the City Gas Distribution network.

ii) To provide a fundamental understanding of the technical and business aspect of the City Gas distribution network.

iii) To make students confident to implement the knowledge of City Gas Distribution in industry

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Introduction**	Natural gas: definition, composition, uses, liquefied natural gas (LNG) compressed natural gas (CNG) and piped natural gas (PNG), Path of flow of natural gas, application in domestic, commercial, and industrial sector, Storage of CNG, Advantages, limitations.	7
2	**Liquefied Natural Gas**	LNG, history, LNG characteristics, LNG properties, need of LNG, LNG chain, liquefaction technology, LNG transportation, LNG terminal, LNG storage, Uses.	6
3	**Distribution**	CGD concept, infrastructure-distribution network, various stations involved: city gas station (CGS), pressure reduction station (PRS), district regulation station (DRS), setting up the network, network pressures, challenges.	7
4	**City gas pipelines and metering**	Market Demand, Type of pipelines used- carbon steel, MDPE and GI and Copper; procedure of carbon steel and MDPE pipe laying, city gas metering- gas meters, gas chromatograph, pressure and temperature transmitter.	7
5	**Operation and maintenance**	Hazards, built-in design, operation preparedness, emergency preparedness- emergency response and disaster management plan, customer related operations, liaisoning.	5

6	**Safety at CGD**	Statutory rules and safety codes, behavioral safety, infrastructure safety, Process safety, Environmental safety, overall safety areas, Safety compliance, Safety kits and equipment, PPE.	6
	Total		**38**

4. Readings

4.1 Textbooks:

1. Natural Gas- A Basic Handbook, James Speight, Gulf Professional Publishing
2. Handbook of Liquefied Natural Gas; S. Mokhatab, J. Mak, J Valappil, David A.Wood; Gulf Professional Publishing
3. Handbook of Natural Gas Transmission and Processing, S. Mokhatab, W. Poe, J. Speight; Gulf Professional Publishing

5. Outcome of the Course:

1) Summarize City Gas Distribution value chain and Natural Gas system.
2) Acquaint and adapt the roles, functions and objectives of PNGRB
3) Explain Piped Natural Gas (PNG) distribution system.
4) Classify the types of Compressed Natural Gas (CNG) Stations and explain the CNG infrastructure.
5) Practice the HSE measures for safety of CGD sector.
6) Assess the steps to be taken in financing the CGD measures.

Unconventional Oil and Gas Resources

1.1 Course Number:PE305
1.2 Contact Hours: 3-0-0   Credits:9
1.3 Semester-offered: 3rd Year - Odd
1.4 Prerequisite: NA
1.5 Syllabus Committee Members: Dr. Chinmoy Jit Sarma, Dr. Satyajit Chowdhury,
    Dr. Sekhar Gogoi & Dr. Srawanti Medhi

2. Objective:

The objective of the course is to introduce the students to the domain of oil and gas resources which are termed as unconventional because of their complexity during drilling and production. It will introduce some unconventional oil and unconventional gas resources. The focus will be on shale gas, coal bed methane, heavy oil, gas hydrates and tight gas reservoirs. The course will also discuss the availability and potential of unconventional resources in the context of India.

3. Couse Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Introduction**	Unconventional resources, occurrence, evaluation of unconventional resource, unconventional oil, unconventional gas, unconventional resource triangle, drilling and production of unconventional oil and gas resources, hydraulic fracturing, Environmental concerns water quality, water utilization, noise control, GHG emissions control and air pollution from hydraulic fracturing.	6
2	**Shale Gas**	Introduction to shale gas, characteristics of a shale gas play: maturity, type of gas, TOC, permeability; exploration and production of shale gas well, hydraulic fracturing steps, dealing flowback water and abandonment, challenges to shale gas production and hydraulic fracturing, shale gas resource in India.	**7**
3	**Coal Bed Methane**	Introduction, coal formation and composition, coal porosity, coal cleat, methane storage, CBM well, gas production, methane migration, production curve for CBM well, CBM potential in India.	6
4	**Heavy Oil**	Introduction and origin of heavy oil, occurrence, heavy oil and extra heavy oil, heavy oil recovery: cold method and hot method, primary cold production, cold heavy oil production with sand (CHOPS), thermal methods, heavy oil transportation: viscosity reduction, drag reduction, in-situ upgrading	6

5	**Gas Hydrates**	Introduction, conditions promoting gas hydrates formation, worldwide locations, gas hydrate resource pyramid, marine gas hydrate and permafrost associated gas hydrate, producing methane from hydrates: water circulation, depressurization, carbon dioxide injection, hydrates in India	6
6	**Tight Gas reservoirs**	Introduction, geological control of tight gas sandstone reservoirs: gas accumulation in low-permeability tight sandstones of a conventional trap and basin centered gas accumulations, general properties: source rock, abnormal pressure, stacking patterns, reservoir quality; drilling and completion scenarios, producing gas from tight reservoirs, tight gas potential in India	5
	Total		36

4. Readings

4.1 Textbooks:

1) Advanced Reservoir Engineering, Tarek Ahmed and Paul D.McKinney, Gulf Professional Publishing
2. Unconventional Oil and Gas Resources Handbook, Y Ma and Stephen Holditch, Gulf Professional Publishing
3. Shale Oil and Gas Handbook, SohrabZendehboudi and AlirezaBahadori, Gulf Professional Publishing
4. Unconventional Oil and Gas Resources- Exploitation and Development, Usman Ahmed and D.Nathan Meehan, CRC Press
5. Coal Bed Methane-Theory and Application; Pramod Thakur, Steven J.Schatzel, KashyAminian, Gary Rodvelt, Morgan H.Mosser and Joseph S.D'Amico, Elsevier

5. Outcome of the Course:

The course will equip students with

1) Knowledge and importance of unconventional oil and gas resources which are emerging topics in today's oil and gas industry
2) Production methods to harness oil and gas from these unconventional resources.
3) The potential of such resources in India and encourage to think of alternatives to conventional oil and gas resources helping reduce dependence on foreign exports in coming decades.

Pipeline Transportation of Oil and Gas

1.1 Course Number- PE306
1.2 Contact Hours- 3-0-0   Credits: 9
1.3 Semester Offered- 3rd Year – Odd
1.4 Prerequisite: NA
1.5 Syllabus Committee members- Dr. Chinmoy Jit Sarma, Dr. Satyajit Chowdhury,
     Dr. Sekhar Gogoi & Dr. Srawanti Medhi

2. Objective:

i) Help students to understand pressure distribution system in Natural Gas Pipelines i.e. low-pressure medium pressure and high-pressure system
ii) Enable students to design of City Gas Distribution Network
iii) To give students knowledge methods of Pipeline Network Analysis i.e. Hardy Cross Methods, Newton Loop Method
iv) Assist students to analyze graph theory applicable for Network Analysis
v) Help students to examine steady state & unsteady state analysis for gas pipelines.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Introduction**	Mode of transportation, scope, advantages of pipeline transportation, planning and evaluation, technical, financial and economics and cost structure, Lease Automatic Custody Transfer.	4
2	**Design of Pipeline**	Overview, Types of onshore/offshore(subsea) pipeline and gathering systems, factors influencing design: physical properties of fluid, physical properties of pipelines, Climatic conditions, Hydraulic Shock/surge and water hammering, Road, railroad and water body(river) crossings, Piping codes and specifications.	6
3	**Flow of Fluids**	Basic planning and initial planning, Types of pipeline system, Laminar and turbulent flow, Compressible and incompressible fluids, Newtonian and non-Newtonian fluids and time dependent and independent fluids, Flow Regimes: bubble, slug, churn, mist, annular.	8
4	**Construction of Pipelines**	Pipeline project construction specifications, Material and equipment, Types of line pipe- seamless line pipe, flexible pipe, composites; Types of valves- gate, plug, ball, check, butterfly and Pressure Relief Devices: safety valve and relief valve, pipe coating.	8

5	**Pipeline Pigging**	Introduction of Pigs, Types of Pigs, pig launchers, Smart pigs/Intelligent pig, Plugs.	5
6	**Corrosion protection**	Causes, Types, Protection: coating, cathodic protection, Internal corrosion, Corrosion Monitoring and control.	5
	Total		36

4. Readings

4.1 Textbooks:

1. Pipeline Rules of thumb Handbook, E.W. McAllister, Gulf Professional Publishing
2. Pipline & risers : Young Boi ,Elsevier Ocean Engineering Book series 2001Volume
3. Piping Handbook, MohinderL.Nayyar, McGraw Hill
4.NACE Corrosion Engineer's Reference Book, Robert Baboian, NACE International

5. Outcome of the Course:

1) Identify pressure distribution system in Natural Gas Pipelines i.e.low-pressure medium pressure and high-pressure system.
2) Design of City Gas Distribution Network i.e.Primary Network, Secondary Network and Distribution Network
3) Evaluate methods of Pipeline Network Analysis i.e.Hardy Cross Methods, Newton Loop Method.
4) Analyze graph theory applicable for Network Analysis
5) Examine steady state & unsteady state analysis for gas pipelines