20HS101P					COMMUNICATION SKILLS-I					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hours/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
0	0	2	1	2	--	--	--	50	50	100

COURSE OBJECTIVES

- Promote reading habit to enhance vocabulary of graduates.
- Promote critical thinking
- Develop communication skills
- Develop writing skills

Unit I **Hours: 7**

Overview of English, Writing Program Policies, Writing Tutors, Campus Resources and Internet Addresses

Unit II **Hours: 6**

Introduction to Academic Writing, Arguments, and Analysis

Unit III **Hours: 7**

Reasoning, appropriacy of style and tone, using appropriate format and fluency, inference, analysis, evaluation and creativity, appreciating literary conventions

Unit IV **Hours: 6**

Narrative/ Expository prose models, prose comprehensions, sentence comprehensions

COURSE OUTCOMES

On completion of the course, student will be able to

CO1- Referring to many external sources for reading helps students in having a comprehensive understanding of different fields

CO2- It takes more than professional skills to be a sucessful professional and a few components help in imparting a new dimension to students' perception

CO3- Problem solving assignments promote critical thinking to offer a solution

CO4- Theoretical topics give an insight into the foundation and requirements of communication for students to become adept at life skills

CO5- Versatile assignments help students look into the various aspects of profession

TEXT / REFERENCE BOOKS

1. Ene, Estelle, Erik Ellis, and Meg Smith. A Student's Guide to First-Year Composition. 25th ed. Plymouth, MI:Hayden-McNeil, 2004.
2. Hacker, Diana. Rules for Writers. 5thed. Boston: Bedford, 2004

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs.**

PART A: 10 Questions of 2 marks each-No choice **20 Marks**

PART B: 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

20MA101T					MATHEMATICS-I					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hours/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	1	0	4	4	25	50	25	-	-	100

COURSE OBJECTIVES

- To be able to analyse complex functions.
- To be able to formulate and solve various engineering problems.
- To understand the basic concepts of matrix and its application.
- To study the complex equations and apply them to solve complex functions.

Unit I **Hours: 10**

Systems of Linear Equations and Matrices: Matrix, Some Definitions Associated with Matrices Systems of Linear Equations, Matrices and Elementary Row Operations, The Inverse of a Square Matrix, Matrix Equations, Rank of the Matrix, Applications of Systems of Linear Equations.

Linear Transformation: Linear Transformations, Composition of Linear transformation The Null Space and Range, Isomorphism, Inverse Linear Transformation, Matrix Representation of Linear Transformations, Similarity.

Eigen Value and Eigen Vectors: Eigen value and Eigen Vectors, Diagonalization, Cayley-Hamilton Theorem, Quadratic Form.

Unit II **Hours: 10**

Vector Spaces: Euclidean Vector Space, Vector Spaces, Subspaces, Linear Combination, Span, Linear Dependence and Independence, Basis, Finite Dimensional Vector Space, Basis and Dimension for Solution Space of the Homogeneous Systems, Reduction and Extension of Basis, Coordinate Vector Relative to Basis, Change of Basis, Row Space, Column Space and Null Space, Rank and Nullity

Unit III **Hours: 09**

Inner Product Spaces: Introduction, The Dot Product on Rn and Inner Product Spaces, Orthogonal Basis Orthonormal Bases, Gram-Schmidt Process, Orthogonal Complements, Application: Least Squares Approximation, Orthogonal Projection Diagonalization of Symmetric Matrices, Application: Quadratic Forms

Unit IV **Hours: 10**

Complex Analysis: Complex numbers, Exponential, Trigonometric, De Moiré's Theorem, Roots of a complex number Function of a Complex variable, Analytic function, Cauchy Riemann equations, Laplace Equation, Harmonic Functions, Harmonic Conjugate functions and their Engineering Applications Conformal mapping and its type, Some standard & special conformal mappings, Definition of a Complex line integral, Cauchy's integral theorem, Cauchy's Integral formula, Residue theorem, Calculation of residues, Evaluation of real definite integrals.

MAX <40 Hrs>

COURSE OUTCOMES

On completion of the course, student will be able to

CO1- Demonstrate an understanding of matrix and calculus

CO2- Apply the techniques of matrix to evaluate large amount of variables.

CO3- Derive various technique to analyse complex function.

CO4- Apply Theorems to solve complex functions.

CO5- Analyze and evaluate the different structure and process using vector.

CO6- Create an interest to solve various real-world problems with physical significance.

TEXT / REFERENCE BOOKS

1. Higher Engineering Mathematics, by B. S Grewal, Khanna Publication, Delhi
2. Higher Engineering Mathematics Vol. 1 by Dr. K.R.Kachot, Mahajan Publishing House
3. Higher Engineering Mathematics Vol. 2 by Dr. K.R.Kachot, Mahajan Publishing House
4. Complex Variables and Applications, by R. V. Churchill and J. W. Brown (7th Edition), McGraw-Hill.
5. Complex Analysis, by J. M. Howie, Springer-Verlag (2004)
6. Complex Variables-Introduction and Applications, by M. J. Ablowitz and A.S. Fokas, Cambridge University Press, 1998 (Indian Edition).
7. Introduction to Linear Algebra with Application, by Jim Defranza, Daniel Gagliardi, Tata McGraw-Hill
8. Elementary Linear Algebra, Applications version, by Anton and Rorres, Wiley India Edition.
9. Advanced Engineering Mathematics, by Erwin Kreysig, Wiley Publication.
10. Elementary Linear Algebra, by Ron Larson, Cengage Learning.
11. Calculus, Volumes 2, by T. M. Apostol, Wiley Eastern.
12. Linear Algebra and its Applications, by David C. Lay, Pearson Education

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs.**

PART A: 10 Questions of 2 marks each-No choice **20 Marks**

PART B: 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

20PEB103					PHYSICS					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hours/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
2	0	0	2	2	25	50	25	-	-	100

COURSE OBJECTIVES

- Demonstrate the fundamentals of vector, electrostatics wave theory and optics.
- Enhance knowledge to relate physics with advanced courses of petroleum engineering.
- Improve skills to interpret real world problems with physical significance
- Develop understanding of wave theory for application in geophysical exploration

Unit I **Hours: 7**

Vector concepts & applications in Physics: Introduction to vector algebra, Physical concepts in vector fields and Scalar fields with examples, Physical and mathematical concepts of gradient, divergence and curl, Green's theorem, Gauss theorem, applications in gravitation and electrostatics. Stokes' theorem and its applications.

Electrostatics and Electrodynamics: Gauss's law in dielectric medium, Equation of continuity, Biot Savart law – Ampere's law – magnetization and magnetic intensity, Faraday's law of induction – generalization of Ampere's law, displacement current, Maxwell's equations, wave equation for electromagnetic radiation, electromagnetic wave propagation in free space and isotropic dielectric medium, Poynting theorem & Poynting vector.

Unit II **Hours: 6**

Waves and Oscillations: Types of waves, Simple harmonic motion, Damped simple harmonic motion, types of damping, Forced oscillation, resonance, Energy Transport in Wave motion.

Acoustics & Ultrasonic: Introduction to Sound, Sabine's reverberation theory, Acoustical defects and their remedies, Doppler Effect. Ultrasonic waves, methods of their generation and detection, properties and application of ultrasonic waves.

Unit III **Hours: 7**

Kinematics and Dynamics: Kinematics and dynamics of particles, work and energy system of particles, rotational kinematics and dynamics.

Optics: Interference: Types of interferences, Thin film interference, Anti-reflecting films; wedge shape films; Newton's rings and its applications, Diffraction: Diffraction of light waves, Fraunhofer diffraction at a single slit, Two slit Fraunhofer Diffraction Pattern, N- Slit Fraunhofer Diffraction Pattern, diffraction grating, resolving power, Rayleigh Criterion, Fresnel diffraction (Introduction). Polarization: Polarization of light, production of polarized light, types of polarization and their representation, Malus's law, polarizer and analyser, Double refraction, Interference of Polarized light: Quarter wave plates and Half wave plates.

Unit IV **Hours: 6**

Laser & Fibre Optics: Concepts of maser and laser, Interaction of radiation of matter-quantum mechanical view, Einstein coefficients spontaneous and stimulated emission, principles involves in laser, Meta stable state, Population inversion, three and four level laser system, and optical amplification and optical resonator, characteristics of laser, Ruby, He-Ne and semiconductor lasers, Application of lasers, Optical Fiber, physical structure and basic theory, modes in optical fibers, step index and graded index fibers, losses in optical fibers, applications of optical fibers in communication.

MAX <30 Hrs>

COURSE OUTCOMES

On completion of the course, student will be able to

CO1- Demonstrate an understanding of Electrodynamics, Waves theory, kinematics & dynamics and optics.

CO2- Apply the techniques of vector calculus in gravitation and electrostatics

CO3- Demonstrate various diffraction experiments

CO4- Apply sound wave interference knowledge in seismic interpretation.

CO5- Analyze and evaluate the different wave interference.

CO6- Create an interest to apply physics to solve various real-world problems.

TEXT / REFERENCE BOOKS

1. Resnick, Halliday and Krane, Physics part I and II, 5th Edition John Wiely (2002).
2. A. Ghatak, Optics, 3rd edition, Tata McGraw Hill (2005).
3. Kittel C., Knight W.O. and Ruderman M.A., Mechanics - Berkeley Physics Course, Vol. 1, Tata McGrawHill.
4. Purcell E.M. Electricity and Magnetism - Berkeley Physics Course, Vol.2, TataMcGraw-Hill.
5. Crawford F.S. - Waves and Oscillations, Berkeley Physics Course, Vol. 3,McGraw-Hill.
6. Feyman R.P., Leighton R.B. and Sands M. The Feyman Lectures on Physics, Vol. 1., Narosa Publication
7. Feyman R.P., Leighton R.B. and Sands M. The Feyman Lectures on Physics, Vol. 2. Narosa Publication
8. Griffith D.J.H., Introduction to Electrodynamics - Prentice Hall, India.
9. M. N. Avadhanulu, A text book of engineering Physics, S. Chand & Company, Ltd.
10. Brij Lal, N. Subrahmanyam, Heat and Thermodynamics, S. Chand & Company, Ltd.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs.**

PART A: 10 Questions of 2 marks each-No choice **20 Marks**

PART B: 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

20PEB104					GEOLOGY FOR PETROLEUM ENGINEERS					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hours/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	0	3	3	25	50	25	-	-	100

COURSE OBJECTIVES

- Demonstrate the fundamentals of origin of earth.
- Enhance skill to perform study of rocks.
- Improve skills to interpret the geological activities.
- Develop skill to identify petroleum potential of an area.

Unit – I **Hours – 7**

The Earth: Introduction to origin, age, internal structure and constitution of earth; introduction to earth's lithosphere, atmosphere, hydrosphere, and biosphere; plate tectonic theory, tectonic elements of continents and oceans; continental drift; concept of isostacy.

Unit – II **Hours – 14**

Crystallography, Mineralogy and Petrology

Crystallography – unit cell, crystal systems, crystal faces, and crystal symmetry; concept of stereographic projection. Mineralogy – classification of minerals, physical and optical properties of rock forming minerals; classification and structure of silicates; brief descriptions of common silicates viz., olivine, pyroxene, amphibole, mica, feldspar and quartz; Concepts of solid solution and binary eutectic; Bowen's reaction series. Petrology – introduction; classification of rock types; formation, classification, texture and structure of igneous, metamorphic, and sedimentary rocks. Description of common Igneous Rocks viz. Rhyolite, Granite, Pegmatite, Basalt, Dolerite, and Gabbro; Sedimentary Rocks viz. Conglomerate, Breccia, Sandstone, Shale, and Limestone; Metamorphic Rocks viz., Slate, Schist, Gneiss, Quartzite, and Marble. Rock cycle; introduction to weathering of rocks with an emphasis on chemical weathering.

Unit –III **Hours – 8**

Structural Geology

Domain of Structural Geology; concepts of strike and dip; parameters controlling deformation of rocks; deformation in rocks – descriptions of folds, joints, faults and their classifications; unconformity; geological maps and sections; map symbols.

Unit – IV **Hours - 10**

Palaeontology and Stratigraphy

Palaeontology – definition of fossils and classification of organisms; evolution of life; nature of fossil records and processes of fossilization; uses of fossils; introduction to different fossil groups' viz. microfossils, invertebrates, vertebrates, and plant fossils. Stratigraphy – Geological Time Scale; principles of stratigraphy; stratigraphic units; concept of stratigraphic columns; stratigraphic correlation. Physiographic divisions of India; Indian stratigraphy – Precambrian basement of Indian peninsula; stratigraphy of type sections viz., Vindhyans, Gondwana, Jurassics, Cretaceous, and Tertiary.

MAX <40 Hrs>

COURSE OUTCOMES

On completion of the course, student will be able to

CO1- Understand and correlate the different earth-processes;

CO2- Differentiate and classify the different minerals and rocks;

CO3- Estimate the bearing of various physico-chemical and mineralogical parameters on the geo-mechanical properties of the rocks;

CO4- Evaluate the petroleum potential of an area based on the different geological structures;

CO5- Analyze the different strata based on its fossil assemblage, and evaluate the petroleum potential based on the physiography and stratigraphy;

CO6- Correlate the various aspects of geology with the petroleum system.

TEXT / REFERENCE BOOKS

1. Read H.H.: Rutley's Elements of Mineralogy
2. Best M.G.: Igneous and Metamorphic Petrology,
3. Sengupta S.M. – Introduction to Sedimentology
4. Hobbs B. E., Means W.D. & Williams P. F.: An Outline of Structural Geology
5. Kumar, Ravindra: Fundamentals of historical geology and stratigraphy of India
6. Raup D.M. & Stanley S.M.: Principles of Paleontology
7. Roy A.K.: Fossils in Earth Sciences
8. Mukherjee P.K.: A Text Book of Geology
9. G.B. Mahapatra: A Text Book of Geology
10. Emiliani C.: Planet Earth: Cosmology, Geology, and the Evolution of Life and Environment

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs.**

PART A: 10 Questions of 2 marks each-No choice **20 Marks**

PART B: 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

20PEB105 (Audit)					ENERGY AND ENVIRONMENTAL STUDIES					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hours/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
2	0	0	0	2	--	--	--	50	50	PP/NP

COURSE OBJECTIVES

- Demonstrate the impact of energy on environment.
- Enhance knowledge of unconventional and renewable energy.
- Develop the skills to address the demand for clean and green energy.
- Stimulate graduates to discover clean, green and safe energy source.

Unit – I **Hours- 7**

Global environmental studies, biodiversity, Human population and its impact on environment, Energy Resources Classification, Renewable and Non Renewable energy Resources; Tradable and Non tradable; Energy Outlook- Global versus India, Climate and cost of Energy.

Unit – II **Hours- 7**

Exploration & Production of Fossil Fuels- Crude Oil, Natural Gas, Coal, Shale Gas, Gas Hydrates , CBM and CMM

Unit – III **Hours - 6**

Renewable and new Energy Resources, Hydro-Energy- Principle of Hydro power; construction of dams, Components of dams and equipment for generating electricity; Solar Energy- Solar Radiation and its measurement; Solar Energy Collectors; Solar Energy Storage Wind Energy-Basic Principles; Power in the wind; Wind Energy Conversion System (WES) the Wind Mills; Electrical Generation System from wind Mills, Energy storage and transmission; Safety System; Environmental aspects, Bio Energy- Energy from Biomass; Methods for obtaining energy; thermal Gasification of biomass; Pyrolysis (Destructive distillation)

Unit – IV **Hours - 6**

Geothermal Energy- Geothermal Sources; Hydrothermal (Convective) Resources; Geo-pressure Resources; Hot- Dry Rock Resources; Energy from Oceans- Ocean Thermal Electric Conversion (OTEC); Energy from Tides (Tidal energy; Ocean Waves (Energy and Power from the waves; Wave energy conversion devices; Nuclear Energy-Nuclear fusion and Fission, Nuclear Fuels; Process of power generation from Nuclear plants ; Hydrogen Energy- Principle; Hydrogen generation process; Hydrogen Storage and Transportation.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1- Classify energy resources and their impacts on environment

CO2- Demonstrate the utilization of conventional and non-conventional energy resources

CO3- Understand the environmental and energy issues

CO4- Estimate the amount of energy producible from renewable and new energy resources

CO5- Explain the challenges involved in the production of energy from each resource

CO6- Evaluate the demand-supply budget in the energy mix

TEXT / REFERENCE BOOKS

1. GD Rai, Energy Resources.
2. United Nations Framework Classification for Fossil Energy and Mineral Resources
3. Twindle, J and Weir, A. D. (2006) Energy Resources, 2nd Publication, Taylor and Francis Ltd.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs.**

PART A: (Note: the course is AUDIT and grades are Pass/Non Pass based on the (a) attendance, (b) Assignment (c) Viva)

PART B:

20PEB106P					ENGINEERING DRAWING					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hours/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
0	0	4	2	4	0	0	0	50	50	100

COURSE OBJECTIVES

- Demonstrate various graphical projections.
- Improve analytical skills to understand design blueprints.
- Improve skills to prepare designs blueprints for mechanical parts.
- Develop skills to plan site layout for exploration activities

Unit I **Hours 12**

Introduction to Engineering Graphics. Drawing instruments and accessories, lines and dimensioning. BIS - SP46. Use of plane scales and Representative Fraction. Introduction to Engineering curves and their classification. Introduction to principal planes of projections. Projections of the points. Projections of line and True length of line determination when inclined to two reference planes.

.Unit II Hours 10

Orthographic Projections: Principle of projection, Principal Planes of projection, Projections from the pictorial view of the object on the principal planes using first angle projection method and third angle projection method. Sectional View: Principle and applications

Unit III Hours 10

Isometric Projections and Isometric View or Drawing: Isometric Scale, Conversion of orthographic views into isometric projection, isometric view or drawing.

Unit IV Hours 20

Introduction to software such as AutoCAD and ProE/Soildworks. Understanding the fundamentals of 3D printing and application in oil and gas industries

Max<52 Hrs>

COURSE OUTCOMES

On completion of the course, student will be able to

CO1- Draw engineering curves and apply it for designing various equipment components.

CO2- Apply the concept of engineering scale and projection of line for various engineering application and preparation of geological maps.

CO3- Apply the concept for developing product for solids and sheet metal working.

CO4- Comprehend as well as prepare the orthographic drawings of parts and assembly for communication with engineers or workers for designing, analysis, manufacturing and marketing

CO5- Comprehend and develop the assembly drawings in three dimensions.

TEXT / REFERENCE BOOKS

1. N.D.Bhatt and V.M.Panchal “Engineering Drawing”, Charotar Publishing House, Anand
2. K. Venugopal, “Engineering Drawing & Graphics”, New Age International (P) Ltd.
3. D.A.Jolhe, “Engineering Drawing with an Introduction to AutoCAD”,Tata McGraw-Hill Publishing Co.Ltd., New Delhi

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs.**

PART A: 10 Questions of 2 marks each-No choice **20 Marks**

PART B: 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

20PEB107P					PHYSICS PRACTICAL					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hours/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
0	0	2	1	2	0	0	0	50	50	100

COURSE OBJECTIVES

- Demonstrate the unique characteristics of waves
- Enhance knowledge of graduates on application of physics on petroleum
- Imbibe skills to develop minor devices for study purpose.
- Enhance the skill to develop laser hologram.

LIST OF EXPERIMENTS

1. Introduction to Oscilloscope.
2. Study of Interference using Newton's Ring experiment.
3. Determination of thermal conductivity of different solids.
4. Experiment with solar collector.
5. Experimental to determine linear thermal expansion coefficient of solid bodies.
6. Experiment on reflection of Ultrasonic waves.
7. Experiments with heat pump.
8. Determining Plank's constant and Inverse square law.
9. Experiments on diffraction with He-Ne Laser Kit.
10. Study of Hall Effect.
11. Determining semiconductor energy band gap using four probe method.
12. Experiment to study forced oscillations.
13. Study of charging and discharging of capacitive plates.
14. Study of Bio-Savart's Law
15. Experiments on Fiber Optics.
16. Study of Photoconductivity.
17. Determining e/m by Thomson's method.
18. Study of Polarization of light using LASER.
19. Millikan's oil drop experiment.
20. Study of Holography.

** Any 10 experiments will be conducted relevant to theory course.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1- Identify and classify different rock forming minerals

CO2- Identify and classify various Igneous, Sedimentary and metamorphic rocks.

CO3- Interpret and differentiate between different fossil groups for reconstructing paleoenvironment of the studied rocks.

CO4- Analyse the structural maps and evaluate the structural deformation in the map area;

CO5- Correlate the rock types and geological structures with the some aspects of petroleum systems

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs.**

PART A: 10 Questions of 2 marks each-No choice **20 Marks**

PART B: 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

20PEB108P					GEOLOGY FOR PETROLEUM ENGINEERS PRACTICAL					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hours/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
0	0	2	1	2	0	0	0	50	50	100

COURSE OBJECTIVES

- Demonstrate the unique characteristics of various rocks.
- Develop analytical skills to identify various rock specimens.
- Imbibe skills to prepare geological maps.
- Enhance the ability to perform geological studies before reservoir modelling.

LIST OF EXPERIMENTS **Hours: 10**

1. Study of Crystal: Clinographic projection of cube
2. Study of common silicates in Hand Specimens: Quartz, Feldspar, Mica, Garnet, kyanite, Sillimanite
3. Study of Other Minerals in Hand Specimen: Graphite, Gypsum, Barite, Calcite, Aragonite, Corundum, haematite
4. Study of common Igneous Rocks in Hand Specimens: Granite, Basalt, Rhyolite, Syenite, Dolerite, Gabbro
5. Study of common Metamorphic Rock in Hand Specimen: Slate, Phyllite, Schist (Mica, Talc, Chlorite), Gneiss, Marble, Quartzite
6. Study of common Sedimentary Rock in Hand Specimen: Shale, Siltstone, Sandstone, Conglomerate, Breccia, Limestone
7. Study of Thin Sections of Minerals (quartz, feldspar, mica, pyroxene) & Rocks (Granite, Basalt, Gabbro, Schist, Shale, Sandstone, Limestone)
8. Study of Selected Fossils in Hand Specimen
9. Study of Topographic & Geological Maps

COURSE OUTCOMES

On completion of the course, student will be able to

CO1- Identify and classify different rock forming minerals

CO2- Identify and classify various Igneous, Sedimentary and metamorphic rocks.

CO3- Interpret and differentiate between different fossil groups for reconstructing paleoenvironment of the studied rocks.

CO4- Analyse the structural maps and evaluate the structural deformation in the map area;

CO5- Correlate the rock types and geological structures with the some aspects of petroleum systems

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs.**

PART A:

PART B:

16SP101/102/103					NCC/NSS/SPORTS					
Teaching Scheme					**Examination Scheme**					
					Theory			**Practical**		
L	**T**	**P**	**C**	**Hrs/Week**	**MS**	**ES**	**IA**	**LW**	***Participation and Attendance**	**Total Marks**
0	**0**	**2**	**1**	**2**	*** Continuous Evaluation**			**--**	**100**	**100**

COURSE OBJECTIVES

- To develop discipline, character, brotherhood, the spirit of adventure and ideals of selfless service amongst young citizens
- To develop youth leadership in the students.
- To induce social consciousness among students through various camps and 'Shibir' activities.
- To develop skills and physical fitness among students through indoor & outdoor sports, field & track events.

National Cadet Corps (NCC):

Introduction to NCC, Aims and objectives, Structure and organization, NCC Song, Incentives, National Integration and Awareness, Drill, saluting, Personality Development & Leadership, Disaster Management, Social Awareness & Community Development, Health & Hygiene, Adventure camps, Environment Awareness and Conservation, Obstacle Training, Armed forces, Map reading, Field Craft & Battle Craft, Introduction to Infantry Weapons & Equipment, Weapon Training (During camps), Participation into Republic and Independence day ceremonial parades,

National Service Scheme (NSS):

Importance and role of youth leadership, Life competencies, Youth development programmes and youth 'shibir', Health, hygiene and sanitation, Youth health, lifestyle, first aid, youth and yoga

Sports:

Importance of sports/games in life, Physical fitness, Introduction to various games and sports, field and track events, Physical training, exercises, running, walking, jogging, Teaching of different sports/games, track & field events , demonstration, practice, skills and correction, Introduction to Yoga & Meditation.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 – **Understand** the importance of Nation building and individual contribution to the same.
CO2 – **Integrate** physical fitness and mental wellbeing
CO3 – **Discover** grassroots challenges of community
CO4 – **Creating** societal impact
CO5 – **Maintain** discipline and team spirit
CO6 – **Upholding** the value of one for all and all for one

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: --**

* All registered students will be evaluated based on his/her attendance during the NCC/NSS/Sports sessions and participation to camps and other activities.

20PEB110 (Audit)					SWAMI VIVEKANANDA					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hours/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
2	0	0	0	2	--	--	--	50	50	Pass/Non Pass

COURSE OBJECTIVES

- Demonstrate the biography of Swami Vivekananda.
- Stimulate the humanitarian side of graduates.
- Produce psychologically strong graduates
- Enhance self-motivation in graduates.

Unit I **Hours: 07**

Life of Young Naren: Early years – Young Naren and his friends, At the feet of Sri Ramakrishna, Training of the disciple, As a wandering monk, On the World Stage - Trip to America, The parliament of Religions, Vedanta in America, Experiences in the West, Triumphal Return to India – Calcutta and North India, The Himalayas, At Belur Math, Second visit to The West, To Europe, The Journey's End – Last Days, The passing.

Unit II **Hours: 07**

Insights – Karma, Raja, Jnana and Bhakti Yoga: Karma Yoga - Karma and its effect on character, The secret of work, Duty, Freedom. Raja Yoga – Prana, Control of Psychic Prana, Dharana, Dhyana and Samadhi. Jnana Yoga – Real Nature of man, Maya and Illusion, God in Everything, Realisation, Cosmology, Freedom of the soul. Bhakti Yoga – Need of Guru, Incarnate teachers and incarnations, Om: Word and Wisdom.

Unit III **Hours: 07**

Swamiji'sThougths and Story: On The Ramayana and Mahabharata, Thoughts on the Gita, The story of Prahalada and Jada Bharata, The Great teachers of the World, On Lord Budhha, Christ, Indian Religious Thoughts, Art in India, The Claims of Religion, Concentration and Meditation, Spiritual Research.

Unit IV **Hours: 05**

Modern, Rational and Universal Teachings: Divinity of man, Call to the youth of India, Self-confidence, Faith-The source of strength, The power of will, The power of mind, Self-motivation, Education, Religion, Love and purity, Give Up Superstition, True Effort, Be Brave, Service, Way to success, Leader and Organization, Secret of work.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1- Summarize the life of Swami Vivekananda and his childhood.

CO2- Describe the contribution of Ramakrishna in Swami Vivekananda's life.

CO3- Summarize the contribution of Swami Vivekananda to world religion of parliament.

CO4- Synthesize the teachings of Swami Vivekananda.

CO5- Enumerate the contribution of Swami Vivekananda to India and World.

CO6- Practice the teachings of Swami Vivekananda's disciples.

TEXT / REFERENCE BOOKS

1. Banhatti, G.S.; Life and Philosophy of Swami Vivekananda; New Delhi: Atlantic Publishers &Dist, 1995.
2. Desh Raj Sirswal; Value Education and Philosophy (A tribute issue to Swami Vivekananda); Milestone Education Review, 2014
3. Swami Vivekananda; Living at the Source: Yoga Teachings of Vivekananda; Shambhala Editions, 1993

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs.**

PART A: (Note: the course is AUDIT and grades are Pass/Non Pass based on the (a) attendance, (b) Assignment (c) Viva)

PART B:

20PEB111 (Audit)					GANDHIAN THOUGHTS					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hours/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
2	0	0	0	2	--	--	--	50	50	Pass/Non Pass

COURSE OBJECTIVES

- Demonstrate the biography of Mahatma Gandhi.
- Stimulate ethical thinking in graduates.
- Produce spiritually strong graduates
- Enhance self-motivation in graduates.

Unit I **Hours: 05**

Life and Basic Works of Mahatma Gandhi, Sarvodaya.

Unit II **Hours: 07**

Truth and Non – Violence, Gandhian Approach to Science, Technology and Development

Unit III **Hours: 07**

The Constructive work and Human Liberation, Satyagraha and Peace Making

Unit IV **Hours: 07**

Gandhian way of Management and Trusteeship, Gandhian Futurology, Gandhian Life Style, Contemporaries of Mahatma Gandhi.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1- Recognize the influence of Gandhiji's family background in molding him

CO2- Draw out the various religious influences on life of Gandhi

CO3- Evaluate community life in Gandhi's ashrams and basic idea of satyagraha

CO4- Recognize the involvement of Gandhiji in social movements

CO5- Explain the core Gandhian philosophical ideas and idea of Sarvadharma samabhava

CO6- Recognize Gandhian ideas of satyagraha

TEXT / REFERENCE BOOKS

1. Gandhi, M. K. My experiments with truth
2. Hingorani, A. T and Hingorani, G. A. (1985) The Encyclopaedia of Gandhian Thoughts
3. Gupta, A. A. Gandhian ThoughtsN.D.Bhatt and V.M.Panchal "Engineering Drawing", Charotar Publishing House, Anand

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs.**

PART A: : (Note: the course is AUDIT and grades are Pass/Non Pass based on the (a) attendance, (b) Assignment (c) Viva)

PART B:

20MA103T					MATHEMATICS-II					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hours/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	1	0	4	4	25	50	25	-	-	100

COURSE OBJECTIVES

- Demonstrate the fundamentals and theorems of the course
- Promote critical thinking
- Improve skills to evaluate the solutions of reservoir flow equations.
- Improve mathematical skills for modelling and simulation.

Unit I **Hours: 10**

Infinite Sequences and Series: Introduction of Convergence, Divergence of Sequences and Infinite Series The nth term test for Divergence, Integral Test, Comparison Test, Ratio Test, Root Test, Alternating Series, Absolute convergence, Conditional convergence, Power Series & Radius of convergence Taylor's series, Maclaurin's series, Successive differentiation, Leibnitz theorem (without proof)

Curve Sketching: Concavity Curve sketching, Polar co-ordinates, Relation between Polar and Cartesian Co-ordinates, Graphs in Polar co-ordinates

Indeterminate Forms: Indeterminate form $\left(\frac{0}{0}, \frac{\infty}{\infty}, \infty \times 0, \infty - \infty\right)$, indeterminate form $(0^0, 1^\infty, \infty^\infty)$

Unit II **Hours: 10**

Partial Derivatives: Function of 2-variables, graphs, level curves, Limit, continuity of function of several variables, Partial derivatives and Clairauts' theorem, Tangent plane, Normal line, Linear approximation, Total differential, Chain rule, implicit differentiation, Euler's theorem for homogeneous function, Maximum and minimum values by second derivative test, Lagrange multipliers, Taylor's formula for two variables.

Improper Integrals: Improper integrals of Type- I and Type – II, Convergence and divergence of improper integrals

Unit III **Hours: 10**

Multiple Integrals: Double integrals over rectangles and Fubini's theorem, Properties of double integrals Double integrals over general region, Double integrals in polar co-ordinates, Triple Integrals, Triple integrals in cylindrical coordinates, Triple integrals in spherical co-ordinates, Change of Order of Integration, Jacobian of several variables, Change of variable in multiple integrals.

Application of Integration: Volume by slicing, Volume of solids of revolution by disk method, Volume of solids of revolutions by washer method, Volume by cylindrical shell.

Unit IV **Hours: 09**

Vector Functions: Vector & Scalar Functions and Fields, Derivatives Curve, Arc length, Curvature & Torsion Gradient of Scalar Field, Directional Derivative, Divergence of a Vector Field, Curl of a Vector Field,

Vector Calculus: Line Integrals, Path Independence of Line Integrals, Green`s Theorem in the plane, Surface Integrals, Divergence Theorem of Gauss, Stokes`s Theorem.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1- Understand analytic function of a complex variable and able to apply Cauchy integral theorem and residue theorem to solve contour integrations

CO2- Solve engineering problems using the principles of solution of differential equations.

CO3- To solve partial differential equations

CO4- Apply Laplace transform and its inverse to solve initial value and other related problems.

TEXT / REFERENCE BOOKS

1. Higher Engineering Mathematics Vol. 1 by Dr. K. R. Kachot, Mahajan Publishing House
2. Higher Engineering Mathematics, by B. S Grewal, Khanna Publication, Delhi.
3. Calculus (5th Edition), by James Stewart, Thomson (2003).
4. Higher Engineering Mathematics, by R. K. Jain & S. R. K. Iyernagar
5. Thomas' Calculus, eleventh edition, Pearson.
6. E.Kreyszig, Advanced engineering mathematics (8th Ed.), John Wiley (1999).
7. Advance Engineering Mathematics, by Michael D. Greenberg.
8. Engineering Mathematics, A Programmed Approach, by C. W. Evans, Stanley Thornes Publishers Ltd.
9. Calculus, Volumes 1 and 2, by T. M. Apostol, Wiley Eastern.
10. Calculus, by Robert T. Smith & Ronald B. Minton, McGraw-Hill.
11. Calculus – Single and Multivariable, by Hughes – Hallett et al., John-Wiley and Sons.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs.**

PART A: 10 Questions of 2 marks each-No choice **20 Marks**

PART B: 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

20PEB122					CHEMISTRY					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hours/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	1	0	4	4	25	50	25	-	-	100

COURSE OBJECTIVES

- Demonstrate the fundamentals of physical and organic chemistry.
- Imbibe reaction mechanisms into graduates
- Improve analytical skills of graduates
- Improve skills to synthesize chemicals/catalyst.

UNIT I **Hours: 10**

Physical Chemistry: Reactions and Mechanisms:; Surface Chemistry: Interparticle forces, adsorption isotherms, determination of the surface areaof fine powders using BET theory, surface films; Colligative Properties and their Experimental Determination: Boiling Point Elevation, Freezing Point depression, Osmotic Pressure

UNIT II **Hours: 10**

Organic Chemistry:

Organic reactions and their mechanisms: types of organic reactions; general methods of obtaining mechanisms, study of ionic, free radical and other reactions, Alkanes, Alkenes, Alkynes; Markovnikov's rule; Peroxide effect; Bayer's test; Monohydric alcohols; Saytzeff rule; Methods of distinguishing the three classes of alcohols; Aldol condensation; Clemmensen reduction; Wolf-Kishner reduction; Haloform reaction; Cannizzaro reaction; Reformatsky reaction; Wittig reaction; Saturated monocarbozylic acids; Hell-Volhard-Zelinsky reaction; Amino acid; Classification of carbohydrates; Monosaccharides; Mutarotation; Epimerization; Aromatics; Ruff degradation Aromaticity; Huckel rule; Electrophilic substitution reactions; Directive effects of substituents; Aromatic amino compounds ; Carbylamines reaction. Organic Geochemistry.

Unit III **Hours: 10**

Marine Geochemistry: Marine Geochemistry: Ocean as a chemical system: Salinity, Chlorinity, Destiny temperature: ocean circulation and structure of water: Sea water composition; Conservative elements; dissolved gasses, CO_2 distribution etc; Upwelling phenomena; Carbonate dissolution and precipitation; Nutrient elements; Sources and sinks of Dissolved matter and organic Matter; Residence time

Unit IV **Hours: 9**

Organic Geochemistry and Isotope geochemistry: Organic Geochemistry; A brief Biological background, Organic Compound and their nomenclature, Biologically important organic compounds; Carbohydrate, Lipids, Proteins, Introduction to isotope geology; Discovery or radioactivity and isotopes; Isotope in earth sciences; Nuclide types and their abundances; Decay mechanism of radioactive atoms; basic Principles of radiometric dating; Stable isotope Systematic: elementary knowledge about fractionation of stable isotopes; Stable isotopes and petroleum; mass spectrometry.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1- : Illustrate the fundamental concepts relevant to organic reaction mechanism.

CO2- Understand the basic concept of surface chemistry including analysis of BET surface area and colligative properties.

CO3- Analyse the synthesis and properties of Hydrocarbons (alkane, alkenes and alkynes), monohydric alcohol, monosaccharides, amines, amino acids and aromatic compounds.

CO4- Demonstrate the mechanism of important name reactions.

CO5- Explain the basic and fundamental concepts of marine chemistry.

CO6- Evaluate the principles of organic and isotope geochemistry including important biologically organic compounds.

TEXT / REFERENCE BOOKS

1. Finar I.L., "Organic chemistry" Vol-I, 6th Edition, Pearson Education, 2002.
2. Sharma B.K., "Industrial Chemistry", 12th Edition, Goel Publishing house, 2001
3. Atkins, Peter, 'Physical Chemistry', 8th ed New Delhi : Oxford & IBH Publishing House, 2006.
4. Faure G, "Principles of Isotope Geochemistry"
5. Killops and Killops, "Introduction to organic Geochemistry"
6. White, "organic Geochemistry"
7. "Treatise on Geochemistry", 10 volume set, 2006

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs.**

PART A: 10 Questions of 2 marks each-No choice **20 Marks**

PART B: 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

20PEB123					SEDIMENTARY AND PETROLEUM GEOLOGY					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hours/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	0	3	3	25	50	25	-	-	100

COURSE OBJECTIVES

- Demonstrate the fundamentals of sediments
- Demonstrate the geological process involved in formation of rocks
- Imbibe the knowledge of petroliferous Basins of India
- Improve analytical skills to interpret the geological history with current state of rocks

Unit – I **Hours- 9**

Sedimentology: Subaerial weathering processes: physical and chemical weathering; distinction between soil, alluvium and sediments; Transport and deposition of sediments: fundamentals of fluid flow, particle transport by fluids and by sediment gravity flows. Sedimentary textures: grain size, particle shape, sorting and fabric and their effect on porosity and permeability of sedimentary rocks; sedimentary structures: stratification and bedforms, bedding plane markings; paleocurrent analysis.

Unit – II **Hours- 10**

Sedimentary Rocks and Depositional Environments: Diagenesis of siliciclastic sedments. Classification of siliciclastic sedimentary rocks: rudaceous, aranaceous, and luteceous sedimentary rocks; carbonate sedimentary rocks: textures, classification, diagenesis; other nonclastic sedimentary rocks: evaporites, cherts, coal, oil-shale. Introduction to different types of sedimentary basins. Introduction to depositional environments: Eh-pH fence diagram; continental (fluvial, lake, aeolian), marginal marine (estuarine, lacustrine), shallow marine (tidal flat, beach, deltaic), shelf and deep marine environments.

Unit – III **Hours-10**

Origin and Migration of Petroleum: Introduction to petroleum system. Theories of inorganic, Organic and duplex origin of petroleum. Conversion of organic matter to petroleum: diagenesis of organic matter and formation of kerogens, pristine and phytane; classification of kerogens; catagenesis, and metagenesis of kerogens; thermal maturity indicators. Classification, composition, and physical properties of crude oils; composition of natural gases. Primary, Secondary, and Tertiary Migrations; physico-chemical aspects of migration of petroleum; effects of temperature (geothermal gradients, thermal conductivities of subsurface rocks) and pressure (types and causes of subsurface pressures) on primary and secondary migration; possible modes of primary migration of petroleum; mechanisms of secondary migration under hydrostatic and hydrodynamic conditions; petroleum prospect of sedimentary basins; termination of secondary migration and accumulation of oil and gas; oil/gas saturation in reservoirs. Reconstruction of the migration history.

Unit – IV **Hours- 10**

Petroleum Traps and Petroliferous Basins of India: Traps and their associations. Cap rock and seal formation: lithological aspects and capillary characteristics of seals; diagenetic seals. Trap formation: structural – fold (anticlinal) traps, fault (sealing/non-sealing) traps; growth faults; traps associated with salt domes; stratigraphic – channel sand, up-dip wedges, sand lenses, sand bars; carbonate traps (bioherm and biostrome), etc. Classification of sedimentary basins of India. Structures, petroleum geology of petroleum producing basins of India.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1- recognize, describe and classify the different types of sediments and sedimentary rocks; and petroleum components too;

CO2- understand and analyse the different components of the petroleum system;

CO3- analyse the depositional environment and correlate with the petroleum system;

CO3- evaluate the petrophysical properties of the sedimentary rocks, and estimate the reservoir potential and evaluate the seal integrity;

CO5- evaluate the petroleum source rocks, and estimate the petroleum potential of the petroleum system(s) in a sedimentary basin;

CO6- understand, and analyse the different components of the petroleum systems viz., source rocks, reservoir rocks, migration paths, and traps in the different petroliferous basins of India thereby evaluate the petroleum potential of a sedimentary basin.

TEXT / REFERENCE BOOKS

1. Sengupta S.M.: Introduction to Sedimentology.
2. Kunt Bjorlykke: Sedimentology and Petroleum Geology.
3. F.J. Pettijohn: Sedimentary Rocks.
4. Sam Boggs Jr: Principals of Sedimentology and Stratigraphy.
5. Reineck H.E. and Singh I.B.: Depositional Sedimentary Environments; Springer.
6. Killops and Killops: Introduction to Organic Geochemistry.
7. B.P. Tissot and D.H. Welte: Petroleum formation and occurrence: a new approach to oil and gas exploration.
8. F.K. North: Petroleum Geology.
9. Lavorsen: Petroleum Geology

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs.**

PART A: 10 Questions of 2 marks each-No choice **20 Marks**

PART B: 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

20PEB124					ELEMENTS OF ENGINEERING					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hours/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	0	3	3	25	50	25	-	-	100

COURSE OBJECTIVES

- Demonstrate the fundamentals of civil, electrical and mechanical engineering
- Improve analytical skills to repair/report malfunctions of engine parts accurately.
- Improve skills for site preparation before petroleum exploration activities.
- Improve skills to deal with minor electrical works.

Unit I **Hours: 9**

Introduction : Prime movers and its types, Concept of Force, Pressure, Energy, Work, Power, System, Heat, Temperature, Specific heat capacity, Change of state, Path, Process, Cycle, Internal energy, Enthalpy, Statements of Zeroth Law and First law. **Properties of Gases:** Gas laws, Boyle's law, Charle's law, Combined gas law, Gas constant, Relation between Cp and Cv, Various non-flow processes like constant volume process, constant pressure process, Isothermal process, Adiabatic process, Poly-tropic process. **Properties of Steam:** Steam formation, Types of Steam, Enthalpy, Specific volume, Internal energy and dryness fraction of steam, use of Steam tables, steam calorimeters. **Heat Engines**: Heat Engine cycle and Heat Engine, working substances, Classification of heat engines, Description and thermal efficiency of Carnot; Rankin; Otto cycle and Diesel cycle. **Steam Boilers**: Introduction, Classification, Cochran, Lancashire and Babcock and Wilcox boiler, functioning of different mountings and accessories.

Unit II **Hours: 10**

Internal Combustion Engines: Introduction, Classification, Engine details, four-stroke/ two-stroke cycle Petrol/Diesel engines, Indicated power, Brake Power, Efficiencies. **Pumps and Air Compressors:** Types and operation of Reciprocating, Rotary and Centrifugal pumps. Types and operation of Reciprocating and Rotary air compressors. **Refrigeration & Air Conditioning:** Refrigerant, Vapour compression refrigeration system, vapours absorption refrigeration system, Domestic Refrigerator, Window and split air conditioners. **Couplings: Clutches and Brakes:** Construction and applications of Couplings (Box; Flange; Pin type flexible; Universal and Oldham), Clutches (Disc and Centrifugal), and Brakes (Block; Shoe; Band and Disc). **Transmission of Motion and Power:** Shaft and axle, Belt drive, Chain drive, Friction drive, Gear drive.

Unit III **Hours: 10**

Introduction to Civil Engineering: Branches of Civil Engineering, Scope of Civil Engineering. **Surveying Levelling and Mapping:** Definition of Surveying, Aims and applications, Fundamental principles of surveying, Classification of surveying, Plans and maps, Scales, Units of measurement. Methods of Linear measurement, Instruments used in chain surveying, Selection of stations, Chaining, Ranging, Offsetting, Errors in chaining and correction. Methods of angular measurements, Instruments used, Types of compass, Types of meridians and bearings, Measurement of bearings, computation of angles. Compass traversing and correction of bearings for local attraction. Aims and applications of levelling, Definition of various terms, Instruments for leveling, Methods of leveling, Recording observations in level-book, Computing reduced levels by HI and rise & fall method. Introduction to planimeter, introduction to Global positioning system (GPS), remote sensing (RS) and Geographical information system (GIS), Beam bending, bending of composite beams, transverse sheer, combined loadings, deflection of beams and shafts, stress in columns.

Unit IV **Hours: 10**

Elementary Concepts: Introduction of Electrical Current, Voltage, Power and Energy; Sources of Electrical Energy – Independent and Dependent Source, Source conversion; Ideal electrical circuit elements - Resistor, Inductor and Capacitor; Fundamental laws of electric circuits - Ohm's Law and Kirchhoff"s Laws; Analysis of series, parallel and series-parallel circuits; Star – Delta conversion. **Electrostatics:** Electric charge and Laws of electrostatics; Definitions - Electric field, lines of force, electric field intensity, electric flux and flux density; Electrostatic induction; Gauss's law and its application; Dielectric strength; Capacitor; Capacitor in series and parallel, Energy stored in a capacitor. **Electromagnetism:** Faradays Laws; Lenz's Law; Fleming's Rules; Effect of magnetic field on current carrying conductor; Magnetic circuits; Statically and dynamically induced EMF; Concepts of self inductance, mutual inductance and coefficient of coupling; Inductance in series and parallel; Hysteresis and Eddy current losses; Energy stored in magnetic fields. **Single Phase A.C. Circuits:** Generation of sinusoidal voltage, Definition of average value, root mean square value, form factor and peak factor; Phasor representation of alternating quantities; Analysis with phasor diagrams of R, L, C, R-L, RC and R-L-C circuits; Concepts of Real power, Reactive power, Apparent power and Power factor, Series, Parallel and Series - Parallel circuits; Power in AC circuit, Power factor improvement; Resonance in series and parallel circuits, Qfactor, Bandwidth and Selectivity. **Safety Protections:** Circuit protection devices: Fuses, MCB, ELCB & Relays.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1- Implement the fundamentals of mechanical systems and analyze various heat engines cycles and for oil and gas applications.

CO2- Apply fundamentals of properties of gas and steam in designing the plant equipment or steam injection process for enhance oil recovery.

CO3- Select and identify the problems by understanding construction and working of engines, pump, compressors, air conditioning and power transmission devices and select them for specific application.

CO4- Apply the basic knowledge of electric circuits, electrical and electronic fundamentals to formulate solutions to the problems related petroleum equipment.

CO5- Develop the building layouts and other infrastructure, sub-surface geological maps and demonstrate understanding of transportation system, water conservation.

TEXT / REFERENCE BOOKS

1. Fundamental of Mechanical Engineering by G.S. Sawhney, PHI Publication New Delhi
2. Engineering Thermodynamics by R.K.Rajput, EVSS Thermo Laxmi Publications
3. Surveying and Leveling by N. N. Basak, Tata McGraw Hill Education, Pvt. Ltd. New Delhi
4. Elements of Civil Engineering by Dr. R.K. Jain and Dr. P.P. Lodha, McGraw Hill Education, India Pvt. Ltd.
5. Electrical Technology, Vol – 1, by B.L. Theraja, S. Chand.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs.**

PART A: 10 Questions of 2 marks each-No choice **20 Marks**

PART B: 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

22PEB101T					Transport Phenomena					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	0	3	3	25	50	25	--	--	100

COURSE OBJECTIVES

- To give an introduction to the Petroleum Engineering foundation that requires analysis of Transport Phenomena.
- It helps in formulation of a given physical problem in terms of appropriate conservation equations
- It will help in physical understanding of the Petroleum engineering problems and phenomena

9 Hrs.

UNIT I : Fluids: Statics and Dynamics

Introduction: Continuum, Force, Stress, Strain, Solids vs. Fluids, Types of fluids, Fluid Properties, Newton's law of viscosity, Stokes' theorem, Fundamental Concepts: Fluid flow definition (Eulerian vs. Langrangian), System vs. Control Volume, Fluid Statics: Hydrostatic law, Pascal's law, Pressure at a point, Total Pressure, Barometric Equation. Fluid Kinematics: Types of flow (steady vs. unsteady, uniform vs. non-uniform, laminar vs. turbulent, One, Two and Three dimensional, compressible vs. incompressible, rotational vs. Irrotational), Stream lines, path lines, streak lines, velocity components, stream function. Fluid Dynamics: Bernoulli's equation, Application of Bernoulli's equation

UNIT II: Momentum Transport **10 Hrs.**

Viscosity, temperature effect on viscosity of gases and liquids,
Mechanism of momentum transport, shell momentum balance, pressure and velocity distributions in falling film, circular tube, annulus, slit. Equations of Continuity and Motion. Equation of continuity, motion, mechanical energy, use of equations of change to solve flow problems, comparison of laminar and turbulent flows, time-smoothed equation of change, empirical expressions.

UNIT III: Energy Transport **8 Hrs.**

Thermal conductivity, temperature and pressure effect on thermal conductivity of gases and liquids, Fourier's law, mechanism of energy transport, shell energy balance, temperature distribution in solids and laminar flow with different types of heat source, heat conduction through composite walls, cylinders, spheres, fins, slits.

UNIT IV: Mass Transport **9 Hrs.**

Diffusivity, temperature and pressure effect, Fick's law, mechanism of mass transport, theory of diffusion in gases and liquids, shell mass balances, concentration distribution in solids and in laminar flow: stagnant gas film, heterogeneous and homogeneous chemical reaction systems, The equation of continuity, summary of equations of change and flux.

Max . 36 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1: Estimate the transport properties and describe the governing laws and also to examine the dependency of process parameters on each transport property.

CO2 : Solve differential equations arising in transport problems by setting up shell momentum, energy and mass balance and recognize initial and boundary conditions.

CO3 : Interpret and develop the general equations of change based on conservation of mass and transport entities.

CO4: Simplify the general equations of change for solving momentum, energy and mass flow problems.

CO5 : Solve a time periodic linear momentum, energy and mass transfer problems.

CO6:Analyze the momentum, heat and mass transport problems involved in process equipment.

TEXT/REFERENCE BOOKS

1. R.B. Bird, W.E. Stewart and E.W. Lightfoot, "Transport Phenomena", John Wiley, II Edition 2006.
2. Robert, S Brodkey, Harry C. Hershey, "Transport Phenomena A Unified Approach", Brodkey Publishing 2003.
3. L.S.Sissom, and D.R.Pitts, "Elements of Transport Phenomena", McGraw-Hill, New York, 1972.
4. R.W.Fahien, "Elementary Transport Phenomena", McGraw-Hill, New York, 1983.
5. J.R. Welty, R.W. Wilson, and C.W.Wicks, Rorer G.E, Wilson R.W. "Fundamentals of Momentum Heat and Mass Transfer", V Edn. John Wiley, New York, 2007

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

PART A: <Question: <Short Notes, Problems, Numerical> **20 Marks**

PART B:<Justification, Criticism, Long answers, Interpretation > **80 Marks**

20PEB126P					CHEMISTRY PRACTICAL					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hours/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
0	0	2	1	2	0	0	0	50	50	100

COURSE OBJECTIVES

- Demonstrate co-relation of the experiments with practical problems
- Enhance knowledge to understand multicomponent reservoir fluid sample.
- Improve skills to find out reservoir fluid and rock interaction.
- Support in developing non-damaging fluids for well/reservoir specific operations.

LIST OF EXPERIMENT

1. Estimation of Alcohol
2. Estimation of Aldehydes & Ketones
3. Estimation of Phenol
4. Determination of average molecular weight by viscometer
5. Ore analysis
6. Estimation of Amines
7. Estimation of Aromatics
8. Qualitative analysis of simple Organic compounds.
9. Hydrolysis of Sucrose.
10. Waste Water analysis
11. Adsorption Studies - Freundlich Adsorption Isotherm
12. Determination of Transition Temperature.
13. Determination of Critical solution temperature for the Phenol - Water system.
14. Determination of Saponification value of an oil.
15. To determine the moisture & volatile contents in a given coal sample by proximate analysis.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1- Interpret different types of instruments for qualitative and quantitative analysis of chemicals.

CO2- Identify the organic functional groups in a given sample.

CO3- Determine the physico-chemical properties of single and multicomponent systems.

CO4- Perform quantitative investigation on carbon-based energy source.

TEXT / REFERENCE BOOKS

1. Furniss, and Arthur Israel Vogel. Vogel's Textbook of Practical Organic Chemistry. London: Longman Scientific & Technical, 1989.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs.**

PART A: Evaluation Based on the class performance and Laboratory book **50Marks**

PART B: Viva Examination based conducted experiments **50 Marks**

20PEB127P					SEDIMENTARY AND PETROLEUM GEOLOGY PRACTICAL					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hours/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
0	0	2	1	2	0	0	0	50	50	100

COURSE OBJECTIVES

- Demonstrate the need for studying reservoir rocks and maps.
- Demonstrate the way to prepare various maps.
- Improve skills to study subsurface structure. .
- Support in opting for more advanced study of reservoir modelling and basement mapping

LIST OF EXPERIMENT

1. Study of Sedimentary rocks in Hand Specimen: Sandstone – Detailed study of Different types of Sandstone, Ex. Arkose, Arenite, Wacke with respect to texture (grain size, shape and angularity/roundness), sorting, presence/absence of cement/matrix), porosity, permeability, and their depositional environment.
2. Shale – Detailed study of different types of shales (glauconitic, fossiliferous, and carbonaceous) & their depositional environment.
3. Limestone- Detailed study of different types of Limestone and their depositional environment).
4. Study of shapes of pebbles.
5. Grain size analysis of sediment (Mean, Median, Standard deviation, Skewness, Kurtosis).
6. Study of thin sections of sedimentary rocks (shale, sandstones, limestone) vis-à-vis their porosity and permeability.
7. Study of Isochore maps and construction of sections.
8. Study of Isopach maps and construction of sections.
9. Construction of panel and fence diagrams

COURSE OUTCOMES

On completion of the course, student will be able to

CO1- Understand different minerals in hand specimen

CO2- Analyze silicates in hand specimen

CO3- Analyze fossils in hand specimen

CO4- Understand different types of rocks in hand specimen

CO5- Study clinographic projection of cube

CO6- Interprate topographic and geological maps

TEXT / REFERENCE BOOKS

1. Sengupta S.M.: Introduction to Sedimentology.
2. Kunt Bjorlykke: Sedimentology and Petroleum Geology.
3. F.J. Pettijohn: Sedimentary Rocks.
4. Sam Boggs Jr: Principals of Sedimentology and Stratigraphy.
5. Reineck H.E. and Singh I.B.: Depositional Sedimentary Environments; Springer.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs.**

PART A: 10 Questions of 2 marks each-No choice **20 Marks**

PART B: 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

20PEB128P					SURVEYING PRACTICAL					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hours/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
0	0	2	1	2	0	0	0	50	50	100

COURSE OBJECTIVES

- Demonstrate the need of and procedure of surveying.
- Enhances skill to use the surveying equipment.
- Enhances skills to survey an area swiftly.
- Develop skills to design site preparation plan for exploration activities

LIST OF EXPERIMENT

1. Measurement of offsets for a building using tape survey
2. Compass traverse survey for closed traverse and corrections on internal angles
3. Simple leveling and measurement of gradients
4. Profile leveling and cross-section leveling for a survey line
5. Preparation of a contour sheet for an area
6. Measurement of horizontal and vertical angles using theodolite
7. Measurements using total station
8. Field project using total station

COURSE OUTCOMES

On completion of the course, student will be able to

CO1- Know the principles and procedure of conducting linear and angular measurement survey

CO2- Classify different types of survey methods and its advantages

CO3- Understand the procedure of conducting survey by using plane table, compass, level and theodolite

CO4- calculate the area, volume and elevation of given site.

TEXT / REFERENCE BOOKS

1. Surveying and Levelling Vol. I and Vol. II by T. P. Kanetkar and S.V.Kulkarni , Pune Vidyarthi Griha Prakashan.
2. Surveying and Levelling by Subramanian, Oxford University Press.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs.**

PART A: 10 Questions of 2 marks each-No choice **20 Marks**

PART B: 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

16SP201/202/203					NCC/NSS/SPORTS					
Teaching Scheme					Examination Scheme					
					Theory			Practical		
L	T	P	C	Hrs/Week	MS	ES	IA	LW	*Participation and Attendance	Total Marks
0	0	2	1	2	* Continuous Evaluation			--	100	100

COURSE OBJECTIVES

- To develop discipline, character, brotherhood, the spirit of adventure and ideals of selfless service amongst young citizens
- To develop youth leadership in the students.
- To induce social consciousness among students through various camps and 'Shibir' activities.
- To develop skills and physical fitness among students through indoor & outdoor sports, field & track events.

National Cadet Corps (NCC):

Introduction to NCC, Aims and objectives, Structure and organization, NCC Song, Incentives, National Integration and Awareness, Drill, saluting, Personality Development & Leadership, Disaster Management, Social Awareness & Community Development, Health & Hygiene, Adventure camps, Environment Awareness and Conservation, Obstacle Training, Armed forces, Map reading, Field Craft & Battle Craft, Introduction to Infantry Weapons & Equipment, Weapon Training (During camps), Participation into Republic and Independence day ceremonial parades,

National Service Scheme (NSS):

Importance and role of youth leadership, Life competencies, Youth development programmes and youth 'shibir', Health, hygiene and sanitation, Youth health, lifestyle, first aid, youth and yoga

Sports:

Importance of sports/games in life, Physical fitness, Introduction to various games and sports, field and track events, Physical training, exercises, running, walking, jogging, Teaching of different sports/games, track & field events , demonstration, practice, skills and correction, Introduction to Yoga & Meditation.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 – **Understand** the importance of Nation building and individual contribution to the same.
CO2 – **Integrate** physical fitness and mental wellbeing
CO3 – **Discover** grassroots challenges of community
CO4 – **Creating** societal impact
CO5 – **Maintain** discipline and team spirit
CO6 – **Upholding** the value of one for all and all for one

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: --**

* All registered students will be evaluated based on his/her attendance during the NCC/NSS/Sports sessions and participation to camps and other activities.

20HS201P					Communication Skills-II					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
0	0	2	1	2	--	--	--	50	50	100

COURSE OBJECTIVES

- To understand communication and its process and effect on giving and receiving information.
- To learn and apply communication skills in different public and interpersonal contexts.
- To develop analytical, research, and organizational skills through communication skills for a fulfilling career.

UNIT 1 **7 hrs**

Technical Writing; Report Writing; Creating Lab Journals and Manuals
Portfolio of Critical Writing and Creative Writing; Essay, Story-writing.

UNIT-2 **7 hrs**

Summarizing; Writing Reviews (Books/Articles/Movies/websites); Reading Skills (Advanced)

UNIT 3 **7 hrs**

Digital Literacy
Emails; Creating e-content; Editing and proofreading online; Using grammar and spell check software; Using plagiarism checkers

UNIT 4 **9 hrs**

Group Discussion; Resume Writing Interview Skills

Max. 30 hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO 1 Apply current technology for effective communication leading to better dissemination of knowledge and expertise.
CO 2 Demonstrate relevant knowledge of communication skills in different settings to cater to different purposes and audiences.
CO 3 A sound understanding of communication theory, practice and application to optimize career opportunities.
CO 4 Dynamic communication skills to build and maintain robust and effective professional relationships.
CO5 Augmented communication skills to prepare and present messages, reports and documents in intent and to integrate different sources of information and knowledge.
CO 6 Monitoring and critical reflection on communication skills for the adoption of appropriate strategy required in achieving the desired outcomes.

TEXT/REFERENCE BOOKS

Harmer, Jeremy. The Practice of English Language Teaching. Harlow: Pearson Longman, 2007.
Kaul, Asha. Business Communication. Delhi: Prentice-Hall of India, 2006.
Maley, A. 'Literature in the Language Classroom', The Cambridge Guide to Teaching ESOL, Cambridge University Press, 2001.
Richards, Jack C., and Willy A. Renandya, eds. Methodology in Language Teaching: An Anthology of Current Practice. Cambridge University Press, 2002.
Sharma, Sangeeta and Binod Mishra. Communication Skills for Engineers and Scientists. New Delhi: PHI Learning Pvt. Ltd., 2009.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**
PART A: <Question: <Short Notes, Problems, Numerical> **20 Marks**
PART B: <Justification, Criticism, Long answers, Interpretation > **80 Marks**

20MA205T					Mathematics - III					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	1	0	4	4	25	50	25	--	--	100

COURSE OBJECTIVES

- To understand the concept of Fourier series and Fourier transform
- To conceptualise the heat, wave, and Laplace equation and their solutions
- Expansion of periodic functions/waveforms in terms of sine and cosine functions.
- To acquaint the concept of Fourier transform and their applications in petroleum science
- To become familiar about Geostatistics and its applications in petroleum technology

UNIT 1 Fourier Series and Fourier Transform along its Applications **11 Hrs.**

Periodic function, definition and its properties, definition of a Fourier series of function, need of Fourier series, Dirichlet's condition, Finding the coefficients, Fourier series of even and odd function, Extending the scope of Fourier series, Fourier series of arbitrary interval, convergence of Fourier series, Harmonic analysis, applications of Fourier series.

Introduction, definition, existence, Fourier transform of simple functions, properties of Fourier transform, Fourier Sine and Cosine transforms, Fourier transform in science and engineering, Solving differential equations through Fourier transforms:

UNIT 2 Partial Differential Equation **08 Hrs.**

Partial Differential Equations: Formation PDEs, Solution of Partial Differential equations f(x,y,z,p,q) = 0, Nonlinear PDEs first order, Some standard forms of nonlinear PDE, Linear PDEs with constant coefficients, Equations reducible to Homogeneous linear form, Classification of second order linear PDEs.

UNIT 3 Applications of Partial Differential Equations **10 Hrs.**

Importance of second order partial differential equations and their classification, method of variable separable, physical significance of elliptic, parabolic and hyperbolic equations, One and two dimension heat, Laplace and wave equations in Cartesian and polar coordinates and their solution by variable separable, Laplace and Fourier transform

UNIT4 Geostatistics and its Applications **10 Hrs.**

Introduction to Geostatics, Probability Theory review, Spatial Analysis, Variogram Modelling, Estimation (Global and Local). Cross validation, Estimators (Simple kriging, Indicator kirging, Block kriging); Geostatistical simulation (Cholesky decomposition, conditional simulation, sequential gaussian simulation- SGS)

Total 39 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 – Implement fundamentals of special functions for its application in solving petroleum engineering problems
CO2 – Classify and recognise various Ordinary differential equations and its application
CO3 – Analyse linear differential equation of first and second order
CO4 – appraise the concept of partial differential equation and its application in Petroleum engineering domain
CO5 – solve and apply Fourier series and Fourier integral
CO6 – Examine Laplace transformation and its applications

TEXT/REFERENCE BOOKS

1. Higher Engineering Mathematics, by B. S Grewal, Khanna Publication, Delhi
2. Higher Engineering Mathematics Vol. 1 by Dr. K.R.Kachot, Mahajan Publishing House
3. Higher Engineering Mathematics Vol. 2 by Dr. K.R.Kachot, Mahajan Publishing House
4. Advanced Engineering Mathematics (8th Edition), by E. Kreyszig, Wiley-India (2007).
5. Engineering Mathematics Vol 2, by Baburam, Pearson

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

Part A : 4 questions of 6 marks each	24 Marks (40 min)
Part B: 4 questions of 10 marks each	40 Marks (80 min)
Part C: 3 questions of 12 marks each	36 Marks (60 min)

20PEB202					Applied Physics					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
2	1	-	3	3	25	50	25	--	--	100

COURSE OBJECTIVES

- 1 To impart knowledge in basic concepts of physics relevant to engineering applications
- 2 To introduce advances in technology for engineering applications
- 3 To introduce students to concepts of Classical and Quantum Mechanics
- 4 To introduce students to recognise the techniques of processing advanced engineering materials

UNIT 1 NANOPHYSICS **07 Hrs.**

Nanoscale, Surface to volume ratio, Surface effects on Nanomaterials, Quantum size effects, Electron confinement, Nanomaterials and Nanotechnology, Unusal properties of Nanomaterials, Disadvantages of Nanomaterials Synthesis of Nanomaterials, Carbon Nanotubes: Introduction, Structure, Synthesis, Properties and applications, Applications of Nanomaterials in Petroleum Engineering.

UNIT 2 CLASSICAL MECHANICS **07 Hrs.**

Review of Newtonian mechanics in rectilinear coordinate system. Motion in plane polar coordinates. Conservation Principles. Collision problem in laboratory and centre of mass frame. Rotation about fixed axis. Non inertial frames and pseudo forces. Rigid body dynamics.

UNIT 3 QUANTUM MECHANICS **06 Hrs.**

Two-slit experiment. De-broglie's hypothesis. Uncertainty principle, wave function and wave packets, phase and group velocities,Schrodinger Equation. Probabilities and Normalization. Expectation Values. Application in one dimension: Particle in a box, Finite potential well, Harmonic Oscillator

UNIT 4 ADVANCED ENGINEERING MATERIALS **06 Hrs.**

SHAPE MEMORY ALLOYS: Introduction, Synthesis, Properties and Applications.
METALLIC GLASSES: Introduction, Synthesis, Properties and Applications
BIO MATERIALS: Introduction, Properties and Applications
ENERGY MATERIALS: Solar cells, Fuel cells (H2O2, Lithium cell), Ultra capacitors.

Total 26 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Summarize the fundamentals of nanophysics including synthesis of nanomaterials for its use in energy industry
CO2 - Appraise the application of knowledge of Nanomaterials in Petroleum Engineering problems
CO3 - Able to apply basics of Newtonian mechanics and conversional principles.
CO4 - Apply the knowledge of basic quantum mechanics, to set up one-dimensional Schrodinger's wave equation and its application to a matter wave system.
CO5 - Appraise the synthesis and application of shape metal alloys, and metallic glasses for application in Petroleum Industry.
CO6 - Evaluate the use of Bio materials and solar cells for energy.

TEXT/REFERENCE BOOKS

1. Resnick, Halliday and Krane, Physics part I and II, 5th Edition John Wiely (2002).
2. A. Ghatak, Optics, 3rd edition, Tata McGraw Hill (2005).
3. Kittel C., Knight W.O. and Ruderman M.A., Mechanics - Berkeley Physics Course, Vol. 1, Tata McGrawHill.
4. Purcell E.M. Electricity and Magnetism - Berkeley Physics Course, Vol.2, TataMcGraw-Hill.
5. Crawford F.S. - Waves and Oscillations, Berkeley Physics Course, Vol. 3,McGraw-Hill.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**
PART A: <Question: <Short Notes, Problems, Numerical> **20 Marks**
PART B: <Justification, Criticism, Long answers, Interpretation > **80 Marks**

22PEB201T					Thermodynamics of Petroleum Reservoir Fluids					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	0	3	3	25	50	25	--	--	100

COURSE OBJECTIVES

- To provide the understanding of fundamentals of thermodynamics of reservoir fluids and their phase behaviour
- To provide the concept and understanding of fluid sampling and PVT study
- To provide the understanding of compositional characterization and application of various correlations in real field and simulation application

Unit-1 Reservoir fluids and Hydrocarbon phase behaviour **10 Hrs.**

Reservoir and reservoir fluids, Hydrocarbon-formation in source rock and crude oil in reservoirs, Thermodynamic behaviour – single, two, three and multicomponent system. Physical properties of petroleum reservoir fluids, classification of reservoirs and reservoir fluids

Unit 2 Properties Hydrocarbon components, characterization and correlation **10 Hrs.**

Natural gas properties, behavior of ideal and real gases. Characterizing Hydrocarbon-plus fractions: generalized correlations, PNA determination, splitting and lumping scheme including various correlation methods.

Unit 3 Sampling, PVT properties and laboratory study of PVT **10 Hrs.**

Collection of reservoir fluid samples for PVT study, PVT analysis: Constant composition expansion, flash liberation, differential liberation, separator test for PVT data of hydrocarbon fluids. Evaluation and correlation of physical and chemical properties of reservoir fluids including laboratory and empirical methods. Water from petroleum reservoirs, water production and parameters

Unit-4 Equation of state and application **9 Hrs.**

Vapor-liquid equilibrium calculation, Use of various equations of state for simulation of laboratory PVT data, tuning EOS parameters and original fluid composition calculation.

Total 39 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1- Understand the compositional range of hydrocarbon components present in reservoir fluids with crude typing.
CO2- Understand hydrocarbon phase behaviour in dynamic reservoir conditions.
CO3- Understand chemical characterization of hydrocarbon reservoir fluids and available correlations.
CO4- Design sample collection for various purposed and understand PVT study and analysis
CO5- Analyse situation dependent applicability of different correlation and equation of state (EoS).
CO6- Apply the knowledge for petroleum engineers real field activities.

TEXT/REFERENCE BOOKS

1. Equation of state and PVT analysis: Applications for improved Reservoir Modelling, Tarek Ahmed, Gulf Publishing Company 2007
2. Thermodynamics of Hydrocarbon Reservoirs, Abbas Firoozabadi, McGraw-Hill.
3. PVT and Phase behavior of Petroleum Reservoir Fluids, Ali Danesh, Elsevier, 1998.
4. Properties of Petroleum Rocks and Fluids, Abhijeet Dandekar.
5. PVT Property Correlations: Selection and estimation, Ahmed El-Banbvi, Ahmed Alzahabi, Ahmed El-Maraghi, Gulf Publishing Company 2018

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

PART A: <Question: <Short Notes, Problems, Numerical> **20 Marks**

PART B: <Justification, Criticism, Long answers, Interpretation > **80 Marks**

20PEB204					FLUID MECHANICS					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hours/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	0	3	3	25	50	25	-	-	100

COURSE OBJECTIVES

- Demonstrate the fundamentals of fluid mechanics.
- Improve skills to design flow loops with minimal pressure losses.
- Improve analytical skills to understand complex petroleum engineering problems related to flow assurance.
- Enhance knowledge to understand more advanced courses like transport phenomenon, pipeline engineering etc.

Unit – I **Hours: 10**

Laminar and Turbulent Flow: Definition, relation between pressure and shear stresses, laminar flow through round pipe

Flow Through Pipes and Fittings: Total energy line, Hydraulic grade line, frictional Energy losses through pipe, DarcyWeisbach equation, oody diagram, pipes in series and parallel, Types of fittings, energy losses in fittings.

Unit – II **Hours: 10**

Boundary Layer Theory: Development of Boundary Layer on a flat plate, Laminar and Turbulent Boundary Layers, Von Karman's Analysis, Laminar sub layer, Prandtl 1/7th power law, Separation of Boundary Layer and Methods of Controlling, Flow around Immersed Bodies, Lift and Drag, Classification of Drag, Flow around circular cylinder and Aerofoil, Development of lift on Aerofoil,

Turbulence: Mean and fluctuating velocities, Scale and intensity of turbulence, Prandtl mixing length, Turbulent boundary layers, universal velocity profile and applications.

Unit – III **Hours:10**

Dimensional Analysis: Dimensions of physical quantities, dimensional homogeneity, Buckingham pi Theorem, important dimensionless numbers, Model analysis (Reynolds, Froude and Mach)

FLOW measurement

Application of Bernoulli's equation, Pitot tube, Venturi meter, Orifice meter, Rotameter, Triangular Notch & Rectangular Notch, Mass flow meters etc

Unit – IV **Hours: 09**

Pumps and Compressors

Classification of Pumps, centrifugal pumps, types, and head developed, Characteristic curves, selection criteria. Reciprocating and Rotary pumps, selection criteria,

Compressible fluid flow: Ideal gas relations, Mach number, speed of sound. Isentropic flow of ideal gas. Types of compressors, COP, Selection criteria

Fluid Kinematics: Types of flow (steady vs. unsteady, uniform vs. non-uniform, laminar vs. turbulent, One, Two and Three dimensional, compressible vs. incompressible, rotational vs. Irrotational), Stream lines, path lines, streak lines, velocity components, convective, local and total acceleration, velocitypotential, stream function, continuity equation in Cartesian co-ordinates Fluid Dynamics: Introduction to Navier-Stokes'equation, Euler's equation of motion along a stream line, Bernoulli's equation, Application of Bernoulli's equationTotal

Max <40 Hrs>

COURSE OUTCOMES

On completion of the course, student will be able to

CO1- Understand the principles of fluid flow operations.

CO2- Apply and evaluate the theoretical importance and relevance of fluid flow in chemical process industry

CO3- Comprehend and analyse fluid mechanics problems with the application of conservation principles of mass, energy and the momentum

CO4- Design fluid transportation systems such as pumps, compressors and pipe network etc.

CO5- Evaluate the fluid transportation devices for process applications.

CO6- Compute power requirement in fixed bed system and determine minimum fluidization velocity in fluidized bed

TEXT / REFERENCE BOOKS

1. S. Gupta, Fluid Mechanics and Hydraulic Machines, Pearson Publishers.
2. Cengel and Cimbala, Fluid Mechanics, Tata-McGraw Hill Publishers.
3. F. White, Fluid Mechanics, Tata-McGraw Hill publishers.
4. R. Fox and A. McDonald, Fluid Mechanics, John Wiley Publishers.
5. J. Douglas, J. Gasiorek, J. Swaffield, and L. Jack, Fluid Mechanics, Pearson Publishers.
6. C. Ojha, P. Bernstein and P. Chandramouli, Fluid Mechanics and Machinery, Oxford University Press.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs.**

PART A: 10 Questions of 2 marks each-No choice **20 Marks**

PART B: 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

20PEB205					Geomechanics and Strength of Materials					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	0	3	3	25	50	25	--	--	100

COURSE OBJECTIVES

- To learn stress and strain concept with numerical problems and mechanical properties of material and learn the concept of material failure
- Understand different classes of material, phase diagram of various alloys, their properties and structure
- To study strength of geological material such as rock and soil filled with or without pore fluid and applicable failure theories
- Understand the tectonic stress field and stress classification in subsurface, understanding the effect of pore pressure at depth and various laws governing strength of rock in the presence or absence of pore fluid

UNIT 1 Basics of mechanics **10 Hrs.**

Fundamental assumptions in elementary mechanics of materials; viscoelasticity or rheology; mechanical properties of metals – concepts of stress and strain; stress-strain behavior; inelasticity; elastic properties of materials; tensile properties; elastic recovery during plastic deformation; compressive, shear, and torsional deformation; hardness; variability of material properties; design/safety factors. Testing of material properties. Thermal stresses – bars subjected to tension, asymmetric loading, and stress calculation of cylindrical bodies. Scalar, vector, tensor; composition and resolution of stresses; stress vector acting on a surface; analysis of stress; stress field acting at a point – derivation of equations for □n and □n. Mohr's circle; deviatoric and mean stress; special states of stresses by Mohr's circle; Mohr-Coulomb failure envelope.

UNIT 2 Introduction to Materials Science and Engineering **8 Hrs.**

Introduction to materials science and materials engineering; engineering materials; classes of materials; concepts of processing, structure, properties, and performance of materials; atomic structure of materials – BCC lattice, FCC lattice, cubic centered lattice grain boundaries – computation of volumes and atomic packing factors of various lattices; combining various metals – alloys; solid solution, eutectic, and eutectoid; iron–iron carbide (Fe–Fe3C) phase diagram; classification of steel and cast iron; development of microstructures in iron–carbon alloys – hypoeutectoid, eutectoid, and hypereutectoid; influence of other alloying elements in the iron-iron carbide system; ductile to brittle transition temperature vis-à-vis impact energy

UNIT 3 Introduction to Rock Mechanics **10 Hrs.**

Structural rock mechanics and comminution; strength of geological materials; influence of geological history (burial and uplift) on rocks – normally consolidated and over consolidated rocks; effective stress, undrained modulus of elasticity, coefficient of compressibility, coefficient of consolidation, Significance of drainage path length and the rate of consolidation; stress and strain in geological materials and their measurements; cohesion, friction, and failure; influence of fabric; drained and undrained strength; Atterberg limits.

UNIT 4 Introduction to Reservoir Geomechanics **11 Hrs.**

The tectonic stress field; pore pressure at depth in sedimentary basins; basic constitutive laws; rock failure in compression; tension and shear; faults and fractures at depth; compressive and tensile failures in vertical wells; determination of S3 from mini-fracs and extended leak-off tests and constraining the magnitude of SHmax from wellbore failures in vertical wells; wellbore failure and stress determination in deviated wells; stress fields – from tectonic plates to reservoirs around the world; wellbore stability; critically stressed faults and fluid flow; effects of reservoir depletion

Total 39 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Understand the structure and mechanical properties of different materials viz., metals, soil, minerals and rocks

CO2 - Determine the geo-mechanical properties of materials and predicting the failure based on the various failure theories

CO3 - Estimate the changes in shear strength of reservoir rocks vis-à-vis reservoir production, and its effect on the petrophysical properties

CO4 - Apply the understanding of stress-field to optimize production

CO5 - Evaluate the failure of the wall of the wellbore during drilling activities.

CO6 - Analyze stress-field around boreholes using laboratory data and extending it to field situations.

TEXT/REFERENCE BOOKS

1. Zobak, M. D. Reservoir Geomechanics; (2) Longuemare, P. Geomechanics in reservoir simulation; (3) Nauroy, J. F. Geomechanis applied to petroleum Engineering; (4) Valentin Popov, Contact Mechanics and Friction: (5) Physical Principles and Applications; Bansal R. K. A Textbook of Strength of Materials.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

PART A: <Question: <Short Notes, Problems, Numerical> **20 Marks**

PART B: <Justification, Criticism, Long answers, Interpretation > **80 Marks**

20PEB206					Petroleum Exploration					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	0	3	3	25	50	25	--	--	100

COURSE OBJECTIVES

- To provide the fundamental of petroleum exploration, different methods of geophysical surveys and instruments used for it.
- To provide the understanding of geophysical data interpretation and analysis
- To provide how to examine the acquired data to understand the position and extent of subsurface prospects in terms of depth and aerial

UNIT 1 Fundamentals of Petroleum Exploration **10 Hrs.**

Ingredients of Petroleum Exploration, Concept of source, reservoir, migration, trap and seal, Concept of Play, Lead, Prospect and Drillable Prospect, Types of Petroleum Traps-Structural, Stratigraphic and Combinational traps, Primary and Secondary Migration, E&P Life Cycle, Concept of Reserve, Lease and Reservoir, Techniques of Petroleum Exploration, Geochemical, Gravity, Magnetic, Electrical and seismic method of hydrocarbon exploration.

UNIT 2 Geochemical Analysis **10 Hrs.**

Geochemical seep, Classification of seep by Link, Weathering of seeps, a geochemical program for petroleum exploration, Surface Reconnaissance, hydrocarbon Mud Logging, Rock Pyrolysis, Understanding S1, S2, S3,S1/S1+S2, Production Index, Hydrogen Index and Oxygen Index, Processing and interpretation of Geochemical data.

UNIT 3 Fundamentals of Seismic processing, Interpretation and Attribute **10 Hrs.**

Body waves and surface waves, Rayleigh, Love, P and S wave, Seismic acquisition principle, Seismic refraction and reflection surveys, Land and marine sources, Geophone, Hydrophone and Vibroseis survey, Seismic Fold, Signal and Noise, Seismic Processing, SEG D and SEG Y format, CDP/CMP and NMO, DMO, Seismic migration, Base map, Strike Line and Dip Line, 2D and 3D seismic, inline and cross line, 3D fold, time slice and its importance. Horizon and Fault mapping, Seismic impedance and reflection coefficient, convolution and autocorrelation, Fault skeleton preparation, wrench system Structural and Stratigraphic interpretation, Synthetic generation, Time and depth map, VSP survey, Attributes: Amplitude, Frequency and Sweetness, AVO analysis, Classification of sands, Rock solid attributes.

UNIT 4 G and M Methods **09 Hrs.**

Gravity and magnetic prospecting, Instruments of G&M survey, Gravity and magnetic data correction, Interpretation of G&M anomaly, Correlation of Gravity anomaly with seismic anomaly. SP, Telluric and Magnetotelluric data interpretation, Electrical properties of hydrocarbon, Electrical conductivities, Resistivities of various lithologies, Dielectric constants, land airborne EM, Interpretation and modeling of data, Potential estimation for various buried bodies, Anomaly and well placement based on electrical data. Basic well logs, GR

Total. 39 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1- Evaluate prospects and drillable prospects.

CO2- Understand the petroleum system along with the source analysis

CO3- Examine the Process of gravity, magnetic, seismic and resistivity data acquisition, processing and interpretation will help students to handle instruments like gravimeter, magnetometer, seismometer, seismometer and resistivity meter.

CO4- Integrate gravity and magnetic data to understand the density and magnetic susceptibility of the subsurface.

CO5- Integrate seismic, well log and other geophysical data for volume estimation.

CO6- Examine the structural and stratigraphic data to understand the position and extent of subsurface prospects in terms of depth and aerial extent.

TEXT/REFERENCE BOOKS

1. Supriya Mohan Sengupta, Introduction to Sedimentology, A.A.Balkema publication.
2. Mamdough, R. Gadallah, Reservoir Seismology, Pennwell Books, Pennwell Publishing Company, Tusa, Oklahoma.
3. Telford, W M, Geldart, L.P., Sheriff, R.E. and Keys, D.E., Applied Geophysics, Oxford and IBH Publishing Co Pvt Ltd.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

PART A: <Question: <Short Notes, Problems, Numerical> **20 Marks**

PART B: <Justification, Criticism, Long answers, Interpretation > **80 Marks**

20PEB207P					Petroleum Exploration Practical					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
0	0	2	1	2	--	--	--	50	50	100

COURSE OBJECTIVES

- To provide the fundamental of petroleum exploration, different methods of geophysical surveys and instruments used for it.
- To provide the understanding of geophysical data interpretation and analysis
- To provide how to examine the acquired data to understand the position and extent of subsurface prospects in terms of depth and aerial

List of Experiments

1. Basics of Contouring (Hand Drawn and Computerised)
2. Gravity data Acquisition
3. Gravity Data Processing and Interpretation
4. Magnetic Data Acquisition
5. Magnetic Processing and Interpretation
6. Seismic Data Acquisition (Shallow Seismic-Hammer source)
7. Seismic data processing (Shallow seismic-Hammer source)
8. Seismic data interpretation (Shallow seismic-Hammer source)
9. Unconformity and Seismic facies identification
10. Horizon and Fault Mapping of processed 2D line
11. Identifying Play, Lead and Drillable prospects from seismic data

COURSE OUTCOMES

On completion of the course, student will be able to

CO1- Evaluate prospects and drillable prospects.

CO2- Understand the petroleum system along with the source analysis

CO3- Examine the Process of gravity, magnetic, seismic and resistivity data acquisition, processing and interpretation will help students to handle instruments like gravimeter, magnetometer, seismometer, seismometer and resistivity meter.

CO4- Integrate gravity and magnetic data to understand the density and magnetic susceptibility of the subsurface.

CO5- Integrate seismic, well log and other geophysical data for volume estimation.

CO6- Examine the structural and stratigraphic data to understand the position and extent of subsurface prospects in terms of depth and aerial extent.

TEXT/REFERENCE BOOKS

1. Mamdough, R. Gadallah, Reservoir Seismology, Pennwell Books, Pennwell Publishing Company, Tusa, Oklahoma.
2. Telford, W M, Geldart, L.P., Sheriff, R.E. and Keys, D.E., Applied Geophysics, Oxford and IBH Publishing Co Pvt Ltd.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

PART A: Evaluation Based on the class performance and Laboratory book **50Marks**

PART B: Viva Examination based conducted experiments **50 Marks**

20PEB208P					Geomechanics and Strength of Materials Practical					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
0	0	2	1	2	-	-	-	50	50	100

COURSE OBJECTIVES

- To understanding Geomechanical properties of the reservoir/Seal rocks
- Differentiate between strain energy and strain energy density
- To explain the experimental methods for spring stiffness Test, The tension test
- Understand failure planes in different rocks

List of Experiments

1. Rockwell hardness test
2. Brinell hardness test
3. Impact test
4. Tension test
5. Torsion test
6. Bending test
7. Shear test
8. Compression test
9. Fatigue test(To find endurance limit)
10. Triaxial test of reservoir rocks

COURSE OUTCOMES

On completion of the course, student will be able to

CO1- Understand the structure and mechanical properties of different materials viz., metals, soil, minerals and rocks
CO2- Determine the geo-mechanical properties of materials and predicting the failure based on the various failure theories
CO3- Estimate the changes in shear strength of reservoir rocks vis-à-vis reservoir production, and its effect on the petrophysical properties
CO4- Apply the understanding of stress-field to optimize production
CO5- Evaluate the failure of the wall of the wellbore during drilling activities
CO6- Analyze stress-field around boreholes using laboratory data and extending it to field situations

TEXT/REFERENCE BOOKS

1. Zoback, M. D. (2010) Reservoir Geomechanics,

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

PART A: Evaluation Based on the class performance and Laboratory book **50Marks**
PART B: Viva Examination based conducted experiments **50 Marks**

20PEB209					Rural Internship					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
0	0	0	2	Internship	-	-	-	50	50	100

COURSE OBJECTIVES

- The Internship aims at exploring the students to the life, culture and issues of rural India.
- The Internship exposes students to the socio-economic aspects of Rural India

Rural Internship

During the Internship student will be associated with rural India, exploring

(a) Rural Society
(b) Rural Life
(c) Rural Culture
(d) Rural Development Issues
(e) Rural Economy

Additionally, it also develops inter-personal skills and allied aspect.

Course outcomes:

On successful completion of the course, the student should be able to

CO-1: Summarize Rural Life of India for creating sense of belongingness for the community
CO-2: Demonstrate leadership qualities and societal responsibility
CO-3: Appraise concepts of rural life and rural society for sustainable development
CO-4: Evaluate skills on participatory methodologies and tools used in rural development.
CO-5: Discover cross-cultural learning on rural and development issues for inter-personal growth.
CO-6: Enable the students to appreciate the importance of agriculture, artisans and rural entrepreneurs in Rural India

TEXT/REFERENCE BOOKS

The Course is self-exploratory

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**
PART A: Evaluation Based on the class performance and field book **50Marks**
PART B: Viva Examination based data collected **50 Marks**

20PEB221					Numerical Methods					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
2	1	0	3	3	25	50	25	--	--	100

COURSE OBJECTIVES

- To develop skills of the students to solve ordinary and partial differential equations numerically, numerical integrals, algebraic and transcendental equations.
- To understand the fundamental of interpolation techniques and its applications in petroleum engineering.
- To understand the numerical techniques to solve partial and ordinary differential equations and its applications in petroleum science and technology
- To understand basic concepts of curve fitting and regression analysis and its roles in the petroleum technology such as prediction of petrophysical parameters, establishment of various relationship among the geophysical parameters etc.
- To create the understanding of basic concepts of finite elements methods and it's applications in petroleum science and engineering.

UNIT 1 ROOT FINDING **10 Hrs**

Introduction, Descarte's Sign rule, Bisection Method, Method of false position, Secant method, Iteration method, Extended method of iteration, Newton-Raphson method, It's applications, Solution of nonlinear simultaneous equations, Newton-Raphson method for multiple roots, Horner's method, Lin-Bairstow's method or Method for Complex Root, Graeffe's root squaring method, Comparison of various

UNIT 2 FINITE DIFFERENCES AND INTERPOLATION **11HRS**

Finite Differences: Introduction, Finite differences, Operators: Forward Difference, Backward Difference, Central Difference, Shift Operator, Averaging Operator. Relation between operators, Factorial Notation, Synthetic Division, and Missing term Technique.

Interpolation: Newton Gregory Forward Interpolation Formula, Newton Gregory Backward Interpolation Formula, Gauss's Forward and Backward Interpolation Formula, Stirling'sCentral Difference Formula, Lagrange's Interpolation Formula for unevenly spaced Formula, Inverse Interpolation, Divided Differences, Properties of Divided Differences, Newton's Divided Difference Formula, Relation between Divided Differences and Ordinary Differences.

UNIT 3 NUMERICAL DIFFERENTIATION & INTEGRATION ODE, PDE, SIMULENEOUS EQUATIONS **12 HRS.**

Numerical Differentiation: Introduction, Formulae for Derivatives.

Numerical Integration: Introduction, Newton-Cotes's Quadrature Formula, Trapezoidal rule, Simpson'sone-third rule, Simpson's Three-Eighth rule, Weddle's rule, Romberg's method, Double Integration.

Solution of Simultaneous Algebraic Equations: Direct methods, Iterative methods: Gauss-Jacobi's method, Gauss-Seidal method, Relaxation method.

Numerical Solution of Ordinary Differential Equation: Taylor's method, Euler's method, Runge – Kuttamethod, Modified Euler's method, Predictor Corrector method: Adam's method& Milne's method.

Numerical Solution of Partial Differential Equation: Difference Quotients, Graphical representation, Classification of PDE's of 2nd order, Elliptic equations, Solutions of Laplace equation by Liebmann's iteration method, Poisson's equation, Parabolic equation(One dimension heat equation), Bender-Schmidt method Crank- Nicholson method.

UNIT 4 FEM **07 HRS.**

Introduction to Finite Elements Methods: Introduction to Finite Element Methods, Functionals, Base Functions. Methods of Approximation: The Rayleigh-Ritz Method, The Galerkin Method. The FEM for one dimensional Problems and applications to two dimensional problems.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 – Apply the numerical methods to solve ODE and PDE in reservoir simulation and modelling, fluid flow through porous media and in various applications in petroleum science and technology.

CO2 Construct relationships among various petrophysical parameters, geological parameters, geophysical parameters etc with the help of curve fitting and regression analysis.

CO3 - Understand the applications of partial differential equation in the field of petroleum science and technology such as fluid flow through porous media, seismic wave propagation through the interior of Earth, reservoir simulation and modelling etc.

CO4 - Solve the real life applications of finite elements method in the field of petroleum science

TEXT/REFERENCE BOOKS

1. Numerical Methods in Engineering and Science with Programs in C & C++ by B.S. Grewal, Khanna Publisher.
2. Introductory Methods for Numerical Analysis by S.S. Sastry, Fourth edition, Prentice Hall of India.
3. Numerical Methods for Scientific and Engineering Computation by M.K. Jain, S.R.K. Iyenger and R.K. Jain, 5th edition, New Age International .
4. An introduction to Finite Element Method By J N Reddy, Mc Graw Hill.
5. Advanced Engineering Mathematics by R.K. Jain & S.R.K. Iyenger, 3rd edition, Narosa .
6. Numerical Methods for Engineers by S C Chapra , Raymond P. Canale, Tata McGraw Hill Pub. Co. Ltd.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

Part A : 4 questions of 6 marks each 24 Marks (40 min)

Part B: 4 questions of 10 marks each 40 Marks (80 min)

Part C: 3 questions of 12 marks each 36 Marks (60 min

20PEB222					Drilling Engineering - I					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	0	3	3	25	50	25	--	--	100

COURSE OBJECTIVES

- Demonstrate the equipment and practices of oil well drilling
- Illustrate the Casing practices and Cementing techniques
- Imbibe skills to prepare a Geo-Technical order
- Develop skills to address problems in drilling oil wells

UNIT 1 Basic Drilling Practices **14 Hrs.**

Well Planning, Drilling Rig: Components, Selection and Operating systems - Hoisting, Circulation and Rotary systems, Power transmission, Rig control system. Wire lines and service life evaluation, Drilling Fluids – Basics, Functions, Classification, Properties and Nature. Drilling fluids equipment related to pressure and separation. Formulations of drilling fluid, Mud systems like Pneumatic, Synthetic oil based, Inhibitive and Non-inhibitive Rheology models of drilling fluids Mud Hydraulics and Mud weight and Pressure loss calculations in round trip circulation cycle Water and Oil based drilling fluid testing procedures. Latest advances and emerging trends in drilling fluid like use of NDDF. Advanced mud Technology, Balanced/Underbalanced drilling. Pore Pressure prediction, Fracture pressure, abnormal pressure. Well Planning, GeoTechnical Order (GTO)

UNIT 2 Drill string, Casing and Bit Design **12 Hrs.**

Drill String - Components, functions and design, Casing Practices – Configuration, operation, properties, types and design, casing setting depth and hole sizes, liner design, casing handling practices Drill Bits – Types, Performance and Criteria for design.

UNIT 3 Cementation Techniques **07 Hrs.**

Cementing, Cements & cement slurry: Objectives of cementing, oil well cements, Classification of cement, Slurry design, Slurry additives, Factors influencing cement slurry design, Cementing equipments. Cementing Methods - Primary cementing, Stage cementing, Liner cementing, Plugging, Squeeze Cementing techniques in practice. Deep well cementing, Characteristics of good quality cementation. Cementing calculations.

UNIT 4 Drilling Problems and Remedies **06 Hrs.**

Pipe sticking and failure, Lost circulation, Hole Deviation, Sloughing shale, Formation damage, Bore hole instability. Drill string fatigue failure. Bit failure, wire line failure etc. Fishing and coring operations. Well kick and Blow outs: Problem, symptoms and controlling measures, Hole Cleaning. General equipment and Personnel. Safety and Environmental Impact of Drilling fluid. Waste management, classification of drilling waste, approaches of drilling waste minimization.

Total 39 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Recognise the drilling practices on drill site
CO2 - Express information with increased technical clarity
CO3 - Relate changes with Change in drilling parameters
CO4 - Investigate drilling bottlenecks during drilling
CO5 - Plan a drilling program
CO6 - Recommend optimum conditions to drill a well

TEXT/REFERENCE BOOKS

1. Carl Gatlin (1960), Petroleum Engineering: Drilling and Well Completion, Prentice Hall; 1st Ed.
2. Bourgoyne , Adam T. Jr., Martin E. Chenevert, Keith K. Millheim and F.S. Young Jr. Richardson, TX (1991), Applied Drilling Engineering, Society of Petroleum Engineers
3. Neal J.Adams (1985), Drilling Engineering: A Complete Well Planning and approach, PennWell Books
4. H Rabia (1986), Oil Well Drilling Engineering Principles and Practices, Kluwer Law International
5. Gray and Darley (1988), Composition and properties of drilling and completion fluids, Gulf Professional publishing.
6. ASME Shale Shaker Committee (2004), Drilling fluids processing handbook, Gulf Professional publishing
7. James L. Lummus (1986), Drilling fluids optimization: a practical field approach, PennWell Books

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

PART A: <Question: <Short Notes, Problems, Numerical> **20 Marks**

PART B:<Justification, Criticism, Long answers, Interpretation > **80 Marks**

20PEB223					Reservoir Engineering					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	1	0	4	4	25	50	25	--	--	100

COURSE OBJECTIVES

- Explain the basic concepts of reservoir media, fluid flow and its behaviour
- To provide the difference between single and multiphase flow for reservoir flow system
- How to acquire and analyse the data of reservoir
- To develop the reservoir performance evaluation

UNIT 1 **09 Hrs.**

Introduction to reservoir media –porous and fracture medium, concept of porosity fluid saturation, wettability, capillary pressure and relative permeability for understanding multiphase flow behavior in reservoir system, Salient features of Gas-Oil and Water-Oil relative permeability Curves, Factors affecting relative permeability, Three phase relative permeability, basic laboratory core data analysis for understanding petrophysical parameters.

UNIT 2 **10 Hrs.**

Fundamentals of flow in porous media, Classification of flow system in porous media, Single phase and multiphase fluid flow in different state (steady and unsteady) and different systems (linear, radial, turbulent, spherical) considering compressible, slightly compressible and incompressible fluid, Diffusivity equation and its application for reservoir flow system

UNIT 3 **10 Hrs.**

Reservoir Field operation data acquisition, Basic data of reservoir engineering; PVT data, Core data, Well logging and transient well testing information. Reservoir Drive Mechanism, Application of reservoir engineering principles: volumetrics, material balance and decline curve analysis.

UNIT 4 **10 Hrs.**

Reservoir Engineering activities and management, Reservoir performance analysis, Preparation of development schemes, IOR/EOR and workover jobs for reservoir management, Concept of Reservoir simulation.

Total 39 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Know the basics of fluid properties and petrophysical parameters of the petroleum reservoir system;
CO2 - Assess the importance of various petrophysical parameters for flow behaviour of fluids in multiphase petroleum reservoir system;
CO3 - Understand the different types of flow system existing in a petroleum system in terms of rock, fluid and drive system;
CO4 - Analyse the importance of reservoir data acquisition activities in different stages of reservoir life;
CO5 - Conceptualize sequential reservoir engineering activities;
CO6 - Perform reservoir performance analysis in conjunction with reservoir management concepts

TEXT/REFERENCE BOOKS

1. Fundamentals of Reservoir Engineering – L. P. Dake – Elsevier, 17th Edition, 1998
2. Applied Petroleum Reservoir Engineering (Second Edition)- B. C. Craft and M. F. Hawkins Revised by Ronald E. Terry – Prentice Hall.
3. Worldwide Practical Petroleum Reservoir Engineering Methods – H. C. "Slip" Slider – Pennwell Publishing Company.
4. Advance Reservoir Engineering- Tarek Ahmed and Paul D. McKinney - Gulf Professional Publishing- Elsevier - 2005
5. Applied Reservoir Engineering (Vol – I & II)– C. R. Smith, G. W. Tracy, R. L. Farrar – OGCI Publications -1992.
6. Petroleum Reservoir Rock and Fluid Properties – Abhijit Y. Dandekar- Taylor and Francis-2006.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

PART A: <Question: <Short Notes, Problems, Numerical> **20 Marks**

PART B:<Justification, Criticism, Long answers, Interpretation > **80 Marks**

20PEB224					Heat and Mass Transfer					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
2	1	0	3	3	25	50	25	--	--	100

COURSE OBJECTIVES

- To provide concept of heat and mas transfer, explain the different mode of heat transfer and their applications
- To provide the importance of various modes of heat and mass transfer to solve various engineering problems
- To explain the significance of heat and mass transfer in design of various industrial equipments

UNIT 1 Heat Transfer **7 Hrs.**

Conduction: Steady-state and transient flow through various geometries, Convection: LMTD and NTU, overall heat transfer coefficient. Application of dimensional analysis to convection. Heat transfer rate and Heat transfer coefficient calculations. Double pipe parallel and counter-flow heat exchangers, natural and forced convection through tubes and outside tubes, Shell and tube heat exchanger, and finned tube heat exchanger. Boiling of liquids and condensation of vapours.

UNIT 2 Radiation **7 Hrs.**

Radiation from black and real surfaces, radiation transfer between black and grey surfaces, view factor, radiation shield, and multi-sided enclosures., Thermal insulation, Economic and critical thickness of lagging.

UNIT 3 Mass Transfer **8 Hrs.**

Diffusion in gases: Fick's law, determination and estimation of diffusion coefficient; diffusion through stagnant gas and equimolecular counter-diffusion. Diffusion in liquids: Mass transfer across phase boundaries, two-film theory and mass transfer coefficient.

UNIT 4 **8 Hrs.**

Gas Absorption, adsorption, Extraction and Distillation (flash and differential): Basic principles, laws, and calculations. Equilibrium, co-current and counter-current operations. Ideal stage concept and calculation of number of ideal stages. Efficiency. Packed bed and tray columns.

Max 30 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Ability to understand conduction and convection heat transfer equations to various geometry and solve complex engineering problems

CO2 - Ability to investigate the phenomena of boiling and condensation and analyse the thermal coefficient of various heat exchanger configurations

CO3 - Ability to understand and analyse the radiation heat transfer.

CO4 - Ability to understand the diffusional mass transfer.

CO5 - Ability to understand and design the various mass transfer operations.

CO6 -

TEXT/REFERENCE BOOKS

1. Coulson and Richardson"s Chemical Engineering Vol-1, 6th Ed, Elsevier (Butterworth and Heinemann).
2. Warren L. McCabe, Julian C. Smith, Unit Operations of Chemical Engineering, McGraw Hill.
3. Donald Q. Kern, Process heat transfer, Tata-McGraw-Hill.
4. Badger and Banchero , Introduction to Chemical Engineering, McGraw-Hill

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

PART A: <Question: <Short Notes, Problems, Numerical> **20 Marks**

PART B: <Justification, Criticism, Long answers, Interpretation > **80 Marks**

20PEB225					Well Log and Formation Evaluation					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	0	3	3	25	50	20	--	--	100

COURSE OBJECTIVES

1. To provide the concept of various direct and indirect logging techniques, associated tools and techniques
2. To provide physical principles governing the mechanism of individual logging techniques and interpretation of the geology, mineralogy and petrophysical properties
3. To explain the limitations and capabilities of logging tools and well log analysis to the upstream petroleum industry

UNIT 1 Introduction to Formation Evaluation, Mud Logging, and Coring **12 Hrs.**

Introduction to petroleum formation evaluation: Borehole Environment, Invasion, Symbols and abbreviations used; Temperature and pressure changes, Logging tool characteristics, Mud logging, Hydrocarbon staining on the cuttings, Lithology, and texture of cutting samples, Coring techniques, and analysis; Processes of recording and representation (Log charts with tracks). Correlation of core and logging data. Indirect Methods: LWD/MWD & Wireline Logging, Instruments/Tools details.

UNIT 2 Open Hole Logging **12 Hrs.**

Tool physics, measurement principles and data interpretation of the following including quantitative and qualitative analysis techniques: Calliper log; Electrical logs – SP and Resistivity logs (conventional, induction and micro devices), Radioactive Logs – Gamma Ray (natural and spectral), Neutron, Density and Elemental capture spectroscopy logs; Sonic Logs.

UNIT 3 Special Logs **8 Hrs.**

Nuclear Magnetic Resonance Principles, Porosity and permeability estimation, fluid identification,Image Logs Principles, Fracture detection and Geological interpretation, Dip Meter Logs, Vertical SeismicProfile

UNIT 4 Quantitative and Quantitative Analysis **7 Hrs.**

Quantitative and Quantitative Analysis methods for lithology, shale volume, and Porosity, Sandy shale analysis, Overlay techniques for hydrocarbon estimation

Max. 39 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 : Understand the formation evaluation techniques with various direct and indirect well logging tools and techniques.

CO2: Understand the fundamental principles of well logging techniques.

CO3: Acquisition and validation of the well log data for various techniques.

CO4: Interpretation of formation characteristics in terms of lithological and fluid characteristics.

CO5 : Evaluation of Shale volume, lithology, and saturation using combination of various logs.

CO6: Interpretation of different log data and cross-plot for formation evaluation in integrated way.

TEXT/REFERENCE BOOKS

1. Malcom Rider, Second Edition, 2002: The Geological Interpretation of well logs, Rider French Consulting limited
2. Oeberto Serra & Lorenzo Serra, 2004: Well logging - data acquisition and applications, Edition Serralog, France
3. Jorden J R and Campbell F. L., SPE, New York, 1986: Well Logging Vol. 1 and 2
4. Ellis, D. V. and Singer, J. M. 2nd edition, 2007: Well logging for Earth Scientist, Springer
5. Toby Darling, Well logging and Formation Evaluation, Gulf Professional Publishing, Elsevier Science<Book-2>

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

Part A/Question: <Short Notes, Problems, Numerical> <5-7 > Marks (each)

Part B/Question: <Justification, Long answers, Interpretation > <8-10> Marks (each)

20PEB226P					Programming Languages (Python)					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
0	0	2	1	2	--	--	--	50	50	100

COURSE OBJECTIVES

- 1. To acquire programming skills in core Python.
- 2. To acquire Object Oriented Skills in Python
- 3. To develop the skill of designing Graphical user Interfaces in Python
- 4. To develop the ability to write database applications in Python

UNIT 1 **7 Hrs.**

Introduction to Python: The basic elements of Python, Branching programs, Strings and Input, Iteration Functions, Scoping and Abstraction: Functions and Scoping, Specifications, Recursion, Global variables, Modules, Files Testing and Debugging: Testing, Debugging

UNIT 2 **8 Hrs.**

Structured Types, Mutability and Higher-order Functions: Tuples, Lists and Mutability, Functions as Objects, Strings, Tuples and Lists, Dictionaries Exceptions and assertions: Handling exceptions, Exceptions as a control flow mechanism, Assertions

UNIT 3 **7 Hrs.**

Classes and Object-oriented Programming: Abstract Data Types and Classes, Inheritance, Encapsulation and information hiding,Some Simple Algorithms and Data Structures: Search Algorithms, Sorting Algorithms, Hashtables

UNIT 4 **8 Hrs.**

Plotting and more about Classes: Plotting using PyLab, Plotting mortgages and extended examples. Dynamic Programming: Fibonacci sequence revisited, Dynamic programming and the 0/1 Knapsack algorithm, Dynamic programming and divide and conquer

Total 30 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Identifysituations where computational methods and computers would be useful

CO2 - Given a computational problem, identify and abstractthe programming task involved.

CO3 – Choose the right data representation formats based on the requirements of the problem.

CO4 - Use the comparisons and limitations of the various programming constructs and choose the right one for the task in hand.

CO5 - Write the program on a computer, edit, compile, debug, correct, recompile and run it.

CO6 - Identify tasks in which the numerical techniques learned are applicable and apply them to write programs, and hence use computers effectively to solve the task.

TEXT/REFERENCE BOOKS

1. David Beazley and Brian K. Jones (2013) Python Cookbook, Third edition by
2. Eric Matthes (2013) Python Crash Course, 2nd Edition: A Hands-On, Project-Based Introduction to Programming

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

PART A: <Question: <Short Notes, Problems, Numerical> **20 Marks**

PART B:<Justification, Criticism, Long answers, Interpretation > **80 Marks**

20PEB227P					Numerical Methods Practical					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
0	0	2	1	2	--	--	--	50	50	100

COURSE OBJECTIVES

- To develop the mathematical skills of the students in the areas of numerical methods
- 2. To teach theory and applications of numerical methods in a large number of engineering subjects which require solutions of linear systems, finding eigen values, eigenvectors, interpolation and applications, solving ODEs, PDEs and dealing with statistical problems like testing of hypotheses.
- 3. To lay foundation of computational mathematics for post-graduate courses, specialized studies and research

UNIT 1 **07 Hrs.**

Data representation, error analysis, introduction to MATLAB, Applied MATLAB programming.
Numerical Solution of Algebraic & Transcendental equations: Bisection Method, Method of false position, Secant method, Iteration method, Extended method of iteration, Newton-Raphson method, Newton-Raphson method for multiple roots. Comparison of various methods.

UNIT 2 **10 Hrs.**

Interpolation: Newton Gregory Forward Interpolation Formula, Newton Gregory Backward Interpolation Formula, Gauss's Forward and Backward Interpolation Formula, Stirling'sCentral Difference Formula, Lagrange's Interpolation Formula for unevenly spaced Formula, Inverse Interpolation, Divided Differences, Newton's Divided Difference Formula.

UNIT 3 **08 Hrs.**

Numerical Integration: Trapezoidal rule, Simpson's one-third rule, Simpson's Three-Eighth rule, Weddle's rule, Romberg's method, Double Integration.
Solution of Simultaneous Algebraic Equations: Gauss-Jacobi's method, Gauss-Seidal method.
Numerical Solution of Ordinary Differential Equation: Taylor's method, Euler's method, Runge – Kuttamethod, Modified Euler's method, Predictor Corrector method: Adam's method& Milne's method.

UNIT 4 **04 Hrs.**

Numerical Solution of Partial Differential Equation: Bender-Schmidt method Crank- Nicholson method.

Total 29 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to
CO1 - Enable students to understand various concepts of numerical methods
CO2 - Enable students to understand the theoretical concepts of numerical methods
CO3 - Enable students to various applications of numerical methods in petroleum engineering
CO4 - Enable students to solve and applied differential equation by finite elements methods
CO5 - <>
CO6 - <>

TEXT/REFERENCE BOOKS

1. B.S. Grewal, Numerical Methods in Engineering and Science with Programs in C & C++, Khanna Publishers2010.
2. S.S. Sastry, Introductory Methods for Numerical Analysis, 4th Ed., Prentice Hall of India (2009).
3. M.K. Jain, S.R.K. Iyenger and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, 5th Ed., New Age International (2007).
4. J N Reddy, An Introduction to Finite Element Method,McGraw Hill.
5. R.K. Jain & S.R.K. Iyenger, Advanced Engineering Mathematics, 3rd Ed., Narosa (2002).
6. S C Chapra, Raymond P. Canale, Numerical Methods for Engineers, Tata McGraw Hill Pub. Co. Ltd.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

PART A: Evaluation Based on the class performance and Laboratory book **50Marks**

PART B: Viva Examination based conducted experiments **50 Marks**

20PEB228P					Drilling Engineering Practical					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
0	0	2	1	2	--	--	--	50	50	100

COURSE OBJECTIVES

- To provide the concept of measuring different properties of drilling fluid and cement slurry
- Explain the importance and limitations of all parameters of drilling fluid and cement slurry
- Provide the experimental procedure and data analysis of performed experiments
- To evaluate the drilling fluid and cement slurry properties as per standards

List of Experiments

1. Preparation of WBM and OBM including determination of pH of drilling fluid using pH meter.
2. To calibrate the mud balance and determine the specific gravity / density of the mud.
3. To measure the viscosity of drilling fluid using Marsh funnel viscometer.
4. To determine the Rheology of the drilling fluid using Rheometer.
5. To determine the volumes of Water, Oil and Solids in Drilling Fluid using Retort kit.
6. To determine the Fluid loss using Low-temperature/low-pressure API filtration apparatus.
7. To determine the Sand content in drilling fluid using sand content kit.
8. To determine the alkalinity in Drilling fluid and in filtrate of drilling fluid by titration method.
9. To determine the Total hardness in drilling fluid by titration method. Field procedure to determining the total hardness in mud filtrate.
10. To determine the Calcium and Magnesium in drilling fluid by titration method. Field procedure to determining the Ca in mud filtrate.
11. Field procedure for determining cation exchange capacity.
12. To determine the Emulsion stability using Emulsion stability (ES) meter.
13. To measure the gel or shear strength of drilling fluid using Shearometer.
14. To determine the Resistivity of drilling fluid and mud cake using Analog Resistivity meter.
15. Prepare homogeneous cement slurry with the help of Constant Speed Mixer.
16. To measure the absolute density of cement slurry using pressurized mud balance.
17. To determine the thickening time of cement slurries under simulated wellbore conditions using HPHT Consistometer
18. To condition cement slurry to test temperature to enable further testing using Atmospheric Consistometer.
19. To estimate the volume of filtrate lost to the formation using HPHT Filter Press.
20. To determine the rheological properties and graphical behavior of cement slurries using automated computerized viscometer.
21. To determine the stability of Cement Slurry under static Conditions using free water test.

Total 30 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Determine the drilling fluid properties

CO2 - Design the drilling fluid as per given condition.

CO3 - Decide the sequence for adding the additives to formulate mud with desired properties.

CO4 - Understand the impact of drilling fluid and cement on the environment and decide the procedure to reduce it

CO5 - Analyse the effect of various additives on properties of cement slurry

CO6 - Design the cement slurry for a given wellbore condition

TEXT/REFERENCE BOOKS

1. API RP 13I. 8th Edition, March 2009. Complete Document. Recommended Practice for Laboratory Testing of Drilling Fluids
2. Mitchell, R.F. and Miska, S.Z. (2011) Fundamentals of Drilling Engineering, Society of Petroleum Engineers

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

PART A: Evaluation Based on the class performance and Laboratory book **50Marks**

PART B: Viva Examination based conducted experiments **50 Marks**

20PEB229P					Heat and Mass Transfer Practical					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
0	0	2	1	2	-	-	-	50	50	100

COURSE OBJECTIVES

- To provide the concepts of experimental evaluation, applications and importance of heat and mass transfer
- To provide the significance and difference between various heat transfer methods
- To provide the concepts to conduct experiments for diffusion and mass transfer co-efficient

Heat Transfer Practical's

1. Determination of thermal conductivity of solids
2. Studies in heat transfer by natural convection
3. To compare overall heat transfer coefficients for parallel flow and counter flow in double pipe heat exchanger
4. To study the performance of 1-2 fixed tube sheet heat exchanger and calculate overall heat transfer coefficient
5. Determination of Heat transfer coefficient in laminar flow
6. Heat transfer in turbulent flow
7. Radiation heat transfer
8. Heat transfer studies in plate heat exchanger

Mass Transfer Practical's

1. To determine the % extraction of diluted aqueous organic solution using suitable solvent.
2. To determine the diffusion co-efficient of CCl4 in air & it's variation with temperature.
3. Determine mass transfer co-efficient of liquid (water) evaporation to atmospheric air at elevated temperature.
4. To determine the efficiency of single stage leaching operation.
5. To find out the liquid side mass transfer coefficient KLa in the packed column.
6. To determine the mass transfer co-efficient for dissolution of benzene acid with and without Chemical reaction.
7. To prepare the ternary diagram for a system of three liquid one pair partially soluble system.
8. To determine the mass transfer co-efficient of vaporization of solid into air.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1- Understand the practical importance of thermal conductivity of solids

CO2- Understand the natural convention by heat transfer

CO3- Learn the radiation phenomena in heat transfer

CO4- Implement the concept of extraction method for organic solution

CO5- Understand the diffusion method in practically

CO6- Understand the mass transfer co-efficient in a chemical reaction

TEXT/REFERENCE BOOKS

< Cengel, Y. A. (2007) Heat & Mass Transfer: A Practical Approach, Tata McGraw-Hill Education

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

PART A: Evaluation Based on the class performance and Laboratory book **50Marks**

PART B: Viva Examination based conducted experiments **50 Marks**

20PEB230P					Earth Science and Hydrocarbon Exploration Field Work					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
0	0	6	3	--	--	--	--	50	50	100

COURSE OBJECTIVES

- 1 To prepare students for the field of Petroleum Exploration
- 2 To imply ability of reading maps, planning exploration and taking risk and decision
- 3 To help students in identifying sedimentary rocks and its relation to petroleum system
- 4 To able to help students in identifying and interpreting structural aspects in field.

Laboratory Courses

Practical classes/Field trips shall be based on theory course content of Earth science, Sedimentary geology, Petroleum Geology and Petroleum Exploration courses

Aim : Field familiarization of exploration in sedimentary basin and petroleum System

COURSE OUTCOMES

On completion of the course, student will be able to
CO1 - Analyse, Identify and sample different minerals, rocks and fossils for detailed study
CO2 - Evaluate the structural aspects of an area
CO3 - Differentiate between Source, Reservoir and Trap rocks
CO4 - Perform the geological/Geophysical Mapping of a petroliferous basin
CO5 - Construct the geological and Geophysical maps of the area for exploration and exploitation
CO6 - Integrate and Evaluate the G&G data for predicting hydrocarbon resources

TEXT/REFERENCE BOOKS

1. Coe, A. L. (2011) Geological field techniques, Wiley Blackwell Publication,
2. Compton, R. R. (1962) Manual of Field Geology

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**
PART A: Evaluation Based on the class performance and Laboratory book **50Marks**
PART B: Viva Examination based conducted experiments **50 Marks**

20IF301T					Industry 4.0					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
2	0	0	2	2	25	50	25	--	--	100

COURSE OBJECTIVES

1. To interpret the core elements and basic technologies of Industry 4.0
2. To understand how the core elements and technologies of Industry 4.0 are interconnected
3. To develop a holistic approach to improve processes and products with Industry 4.0

UNIT I: INDUSTRY 4.0 – CONCEPTS & TERMINOLOGIES **08 Hrs.**

Industry 4.0, Smart business model, Technology road-map, Sensing & actuation, Communication, Internet of things (IoT), Cyber Physical Systems and Next Generation Sensors, Visualization, Cloud Computing.

UNIT II: SMART WORLD & SUSTAINABLE ENVIRONMENT **08 Hrs.**

Sensors and their integration, Renewable Energy System, Hybrid Energy System, Smart Grid, Smart Metering, Communication Protocols, 5G Technology, Smart Agriculture, Smart Infrastructure, Physiological Sensors, Human Machine Interface.

UNIT III: SMART MANUFACTURING **08 Hrs.**

Automation Systems, Additive Manufacturing, Micro-Electro-Mechanical Systems (MEMS), Smart Factories and Interconnection, Advanced Robotics – Autonomous and Swarm, Self-Propelled Vehicles, Drones–Unmanned Aerial Vehicle (UAV), 3d Printing, Spacecrafts.

UNIT IV: TRANSFORMING TECHNOLOGIES IN BIOENGINEERING **08 Hrs.**

Establishment of Smart Biotechnology Factory, Artificial Intelligence in Bioprocess Technology, 3D Bio Printing for Tissue Engineering, Simulation Tools, RSM and Box Model, Cyber Physical System based Telemedicine, Real Time Biosensors, Bio nanotechnology, biofuel.

Total Hours 32 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 – Understand the core elements and basic technologies for Industry 4.0
CO2 – Apply the different computational techniques and algorithms for realizing Industry 4.0
CO3 – Transform the traditional business approach by integrating the data and intelligence
CO4 – Develop the traditional industries with intelligent and automated machines
CO5 – Utilize data and intelligence for the development of Smart World
CO6 – Understand the concept, significance and means to achieve sustainable development

TEXT/REFERENCE BOOKS

1. Ustundag Alp, and EmreCevikcan, Industry 4.0: Managing the Digital Transformation, Springer,First Edition, 2018
2. Kaushik Kumar, DivyaZindani, and J. Paulo Davim, Digital Manufacturing and Assembly Systems in Industry 4.0., CRC Press, Taylor & Francis First Edition, 2019.
3. Antonella Petrillo, Raffaele Cioffi, and Fabio De Felice, Digital Transformation in Smart Manufacturing., IntechOpen Publisher, First Edition, 2018.
4. J. Ekanayake, K. Liyanage, J. Wu, A. Yokoyama and N. Jenkins, Smart Grid: Technology and Applications, John Wiley and Sons Ltd., First Edition, 2012
5. Alasdair Gilchrist, Industry 4.0: The Industrial Internet of Things, Apress, First Edition, 2016
6. Ibrahim Garbie, Sustainability in Manufacturing Enterprises: Concepts, Analyses and Assessments for Industry 4.0, Springer, First Edition, 2016

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

Part A/Question: 4 Questions, one from each unit, each carrying 15 marks 60 Marks
Part B/Question: 4 Questions, one from each unit, each carrying 10 marks 40 Marks

20IF301P					Industry 4.0 Laboratory					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
0	0	2	1	2	--	--	--	50	50	100

COURSE OBJECTIVES

1. To comprehend the concept and significance of Industry 4.0
2. To understand core elements and technologies of Industry 4.0 through simulation and experimental studies
3. To explore different software packages and hardware elements involved in realization of Industry 4.0

List of Experiments

1. Basic computations using Python programming.
2. Use simulations to understand the performance/behavior of a system by (i) creating a computational environment that mimics the real world, (ii) generating (synthetic) or loading data from sources, and (iii) testing the hypothesis
3. Introduction to MATLAB programming and SIMULINK
4. 3D printing of Airfoil through rapid prototyping 3D printer
5. Dynamic simulation of drone (unmanned air vehicle) through MATLAB/SIMULINK
6. ANSYS simulation of bending of a beam in an earthquake resist-building
7. Introduction to Arduino Embedded platform.
8. Design of line follower autonomous vehicle.
9. Design of smart meter for recording the electricity consumption
10. Design of smart lighting with the help of proximity sensors.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 – Understand the concept of Industry 4.0 and its significance
CO2 – Understand the resource requirements for the implementation of Industry 4.0
CO3 – Learn the Simulation Packages for Industry 4.0
CO4 – Explore the concept of Smart Infrastructure through simulation studies
CO5 – Inspect embedded platform applications for Industry 4.0
CO6 – Synthesise the solution for the given Industry 4.0 related problem

END SEMESTER LABORATORY EXAMINATION PATTERN

Max. Marks: 100

Continuous evaluation	50 marks
End semester examination and Viva-voce	50 marks

20HS301P					Communication Skills-III					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
0	0	2	1	2	--	--	--	50	50	100

COURSE OBJECTIVES

1. To strengthen the communication skills of professionals to make them ready for the modern workplace.
2. To fine tune their professional skills and expertise using communication skills.
3. To participate in the lifelong learning process with confidence and certainty.

UNIT 1 **7 hrs**

- Writing research proposals
- Writing technical projects

UNIT 2 **12 hrs**

- The Art of Presentation
  - *Sapiens: A Brief History of Humankind* (2011), Yuval Noah Harari
  - *Thank You for Being Late: An Optimist's Guide to Thriving in the Age of Accelerations* (2016), Thomas L. Friedman
  - (Presentation in teams of 4 students each, not more than two from the same branch, with a view to promote cross-disciplinary research)

UNIT 3 **7 hrs**

- Uploading portfolios on Slide Share
  - ✓ Uploading Video modules

Max. 30 hrs.

COURSE OUTCOMES On completion of the course, student will be able to

- CO 1 Demonstrate enhanced communications skills for enhanced team work for a better result.
- CO 2 Apply critical analysis for innovative thinking and well-rounded perspectives in different settings and contexts.
- CO 3 Analysis of situations to identify opportunities for professional and career growth through strong communication skills.
- CO 4 High competence of oral, written and visual communication skills for a workplace ready professional.
- CO 5 Realization and application of communication skills and language processes for multiple perspectives and interdisciplinary approach in profession.
- CO 6Improved communication skills for improved research, organizational, and critical thinking and perspective.

TEXT/REFERENCE BOOKS

- Kaul, Asha. Business Communication. Delhi: Prentice-Hall of India, 2006.
- Maley, A. 'Literature in the Language Classroom', The Cambridge Guide to Teaching ESOL, Cambridge University Press, 2001.
- Richards, Jack C., and Willy A. Renandya, eds. Methodology in Language Teaching: An Anthology of Current Practice. Cambridge University Press, 2002.
- Sharma, Sangeeta and Binod Mishra. Communication Skills for Engineers and Scientists. New Delhi: PHI Learning Pvt. Ltd., 2009.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

PART A: Evaluation Based on the class performance and Laboratory book **50 Marks**

PART B: Viva Examination based conducted experiments **50 Marks**

20PEB301					Production Logging					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
2	0	0	2	2	25	50	25	--	--	100

COURSE OBJECTIVES

- Demonstrate the basics and advanced cased hole logging
- Illustrate the production logging available in oil industry
- Provide firm platform for discussing advance courses.
- Develop analytical skills of the graduate for oil & gas well log analysis

Unit I **Hours: 06**

Basic Cased Hole and Production Environment: Log Presentation of all the Basic Cased Hole Log. Downhole environment, Oil-water flow regime, gas-liquid flow regimes, Gas-liquid models, Brief of PVT for Production logging,

Unit II **Hours: 06**

Advanced Cased Hole Logging: Cased Hole Seismic, Guidance Continuous Tool, Cased Hole Wireline Formation Tester, Formation Interval Tester, Repeat Formation Tester, Correlated Electromagnetic Retrieval (CERT) Tool and Formation Subsidence Monitor Tool.

Unit III **Hours: 06**

Production Logging: Introduction to production logging and its application, Casing Evaluation logs, Flow Velocity, Spinner Flowmeter Tools, Interpretation in Single-Phase Flow, 2-Pass Technique, Radioactive Tracer Tools, Fluid Density Tools, Temperature Tools, Noise Tools, Gravel Pack Logging

Unit IV **Hours: 08**

Log Interpretation and Case studies: Cased hole log interpretation and Application**,** Production logging interpretation equations and techniques. Leak detection, steam injection and Job planning

COURSE OUTCOMES

On completion of the course, student will be able to

CO1- Understand the principles cased and production logs available in the industry

CO2- Frame and present cased hole and production logs in proper format

CO3- Analyse and interpret generalised cased hole and production logs trends

CO4- In depth investigation of actual cased hole and production logs oil & gas well

CO5- Compile reports on the basis of their thorough analysis

CO6- Recommend practical decisions required to mitigate problems in cased hole or production wells

TEXT / REFERENCE BOOKS

1. Cased Hole Log Interpretation Principles/Applications Schlumberger, Texas USA
2. Fundamentals of production logging, By Colin Whittaker, Schlumberger, Texas USA

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

Part A/Question: <Short Notes, Problems, Numerical> <5-7 > Marks (each)

Part B/Question: <Justification, Long answers, Interpretation > <8-10> Marks (each)

20PEB302					Petroleum Production Engineering - I					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
2	0	0	2	2	25	50	25	--	--	100

COURSE OBJECTIVES

1. To provide the concepts of well completion, surface and sub-surface equipment used in oil and gas production operations.
2. To provide the concepts of different well problems and well interventions methods used
3. To provide an understanding of well control procedure and well performance evaluation

7 Hrs.

UNIT 1 Petroleum Production System (Surface & Subsurface Equipment)

Role of Production Engineer/activities performed at various levels of field development and its exploitation. Petroleum Production System-Well Head Equipment, Charismas tree, valves, hangers, flow control devices, packers, tubular and flow lines.

UNIT 2 Well Completion &Testing **6 Hrs.**

Introduction, Well Completion Methods and string components, Different types/designs of well completion, Conventional and unconventional tubular configurations, Conventional & periodic production testing, Perforating oil& gas wells-conventional and unconventional techniques viz, through tubing and tubing conveyed underbalanced perforation techniques, type size and orientation of perforation holes. Well activation, use of compressed air and liquid Nitrogen. Smart wells-intelligent completion.

UNIT 3 Workover **6 Hrs.**

Principle and application of workover methods/Recompletion, Workover fluids,- Well Perforations instruments and techniques,

7 Hrs.

UNIT 4 Well Performance analysis and Optimization

Reservoir considerations, Introduction to inflow performance, Productivity index. Formation damage diagnosis, Skin effect, IPR in case of different drive mechanism. Vogel IPR equation. Pressure loss in tubing, multiphase flow regimes. Choke performance, types of chokes. Overall production system pressure losses, Nodal system Analysis.

Max. 30 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1: Regulate formation damage and find alternative methods to bring the well into production again.
CO2: Analyze the fundamentals of productivity index and future IPR and understand the principles of production optimization.
CO3: Explain properly the principles of sucker rod pump, gas lift system, progressive cavity pump & electrical submersible pump.
CO4: Determine the bottom-hole pressure, well head pressure, and handling oil and gas flow rates of hte reservoir.
CO5: control in case of any calamity during installations at drilling or production.
CO6: Evaluate the understanding of water control and sand control.

TEXT/REFERENCE BOOKS

1. Dr. GuoBoyun , Computer Aided Petroleum Production Engineering
2. H Dale Begg , Production Optimization , OGCI Publication,tulsa.
3. Kermit Brown, Technology of artificial lift method –. Vol2a ,2b. Penwell publishing company, Tulsa.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

Part A/Question: <Short Notes, Problems, Numerical> <5-7 > Marks (each)

Part B/Question: <Justification, Criticism, Long answers, Interpretation > <8-10> Marks (each)

20PEB303					Petroleum Refinery Engineering					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
2	0	0	2	2	25	50	25	--	--	100

COURSE OBJECTIVES

- To provide the concept of petroleum refining and explain the different methods of petrochemical reactions and their applications
- To provide the importance of various refining processes and their applications
- To explain the significance petrochemicals productions

UNIT 1 **7 Hrs.**

Types of crudes, crude composition Characteristics and classification–Crude oil properties. IS 1448: Standard –Testing of Petroleum crude–Products: Specifications and their Significance.

UNIT 2 **6 Hrs.**

Pre-treatment of crude for Refining–Dehydration and desalting–Atmospheric distillation, Vacuum distillation of residue products–Treatment techniques for vacuum distillates with different processes like solvent extraction –DE asphalting, dewaxing, hydro fining, catalytic dewaxing and clay contact process– Production of lubricating oils. Hydro cracking, principles, process requirements, product yields and qualities and reside-cracking –Hydrotreating –Sulphur removal, hydro finishing.

UNIT 3 **6 Hrs.**

Thermal cracking – Processes, operating parameters, feed stock selection and product yields, Advantages –Types and functions of secondary processing – Visbreaking – Processes, operating parameters and advantages–Coking –Operating parameters and advantages. Fluid catalytic cracking –processes, operating parameters, feed stock selection and product yields –Advantages.

UNIT 4 **7 Hrs.**

Principle, Processes, Operating Parameter and advantages of Reforming – Isomerisation – Alkylation – Polymerization. Asphalt manufacture, Air blowing technology, Bitumen Types and their properties, Acid gas removal and sulphur removal techniques.

Max. 30 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Introductory information about origin, exploration and production of petroleum crude and understand their properties with the help of standard testing protocols.

CO2- Recognize various primary crude processing techniques like distillation, de-asphalting, hydrocracking, hydrotreating, and their supporting processes.

CO3- Recognize various secondary thermal cracking, catalytic cracking and reforming and coking and their supporting processes.

CO4- Understanding the process technologies for reforming, isomerization, alkylation and polymerization unit process.

CO5- To understand and evaluate various residue processing schemes.

CO6- To apply the finishing processes to petroleum products for meeting the market specifications in view of fuel quality and environmental regulations.

TEXT/REFERENCE BOOKS

1. Dr. B.K. Bhaskara Rao, Modern Petroleum Refining Processes (5th Edition)
2. Dr. B.K. Bhaskara Rao, A Text Book on Petrochemicals.
3. Marshall Sitting, Dryden's Outlines of Chemical Technology

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

Part A/Question: <Short Notes, Problems, Numerical> <5-7 > Marks (each)

Part B/Question: <Justification, Criticism, Long answers, Interpretation > <8-10> Marks (each)

20PEB304					Well Test Analysis					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	1	0	4	4	25	50	25	--	--	100

COURSE OBJECTIVES

- This subject teaches students about the importance of well-testing analysis and its objectives of well testing is; to see if the well will flow or not, to see what fluid a well would produce, to see if the well would flow naturally or to be pumped, to the surface, to see what rates of flow were possible,
- To check existence of communication between different wells, to determine reservoir and flowing pressure, to determine reservoir parameters and to detect no flow boundaries if they exist.

10 Hrs.

UNIT 1 Introduction of Well Test Analysis:

Importance and types of pressure tests, Pressure recorder: Measurement instruments used for bottom hole studies-Calibration of pressure recorders, Indicator diagram. Diffusivity equation, linearization and solution under semi steady state, steady state and applications. Constant Terminal Rate Solution, Line source solution.

10 Hrs.

UNIT 2 Oil Well Testing

Pressure Transient Tests: Horner's Plot, Pressure Build-up Test / Draw-down tests, RLT (Reservoir Limit Test), Determination of average reservoir pressure. Skin factor and average reservoir permeability, Drill Stem Testing: Equipment, DST Chart observation, analysis & interpretation, Wire line formation tests, Modular Dynamic Test.

10 Hrs.

UNIT 3 Gas Well Testing

Russel: good rich solution of diffusivity equation. Real gas pseudo pressure function and its use in diffusivity equation. Non-Darcy's effect and evolution. Gas Well testing: Multi rate test of gas well, pressure build-up and draw down in gas reservoir. Flow after flow (Multi-rate Test), isochronal & Modified isochronal tests. Skin factor and average reservoir permeability. Determination of average reservoir pressure

9 Hrs.

UNIT 4 Advanced Pressure Transient Analysis

Interference and pulse tests, Pressure Fall Off test in Injection wells. PBU / PDD in Horizontal wells. Principle of Superposition, Deconvolution of Pressure Data. Type Curves analysis, interpretation & their uses.

Max. 39 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO-1: Illustrate the principle governing equations of transient well testing and their solutions.

CO-2: Compare various types of transient well testing methods and their requirement for petroleum exploitation activities.

CO-3: Analyse and interpret well test data for determination of petrophysical parameters in dynamic flow conditions around a well.

CO-4: Understand important of safety and precautions against accident at the time of well testing and also understand standard procedure to control of well.

CO-5: Illustrate Advanced Pressure Transient Analysis method.

TEXT/REFERENCE BOOKS

1. Well Test Analysis by John Lee,
2. Modern Well Test Analysis by R.C. Erlougher,
3. Fundamental of Reservoir Engineering by L.P. Dek,
4. Applied Reservoir Engineering by Craft and Hawkins
5. Well Testing Analysis by Mathews and Russell,
6. Gas Well Testing Handbook, Amanat U. Chaudhry

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

Part A/Question: <Short Notes, Problems, Numerical> <5-7 > Marks (each)

Part B/Question: <Justification, Criticism, Long answers, Interpretation > <8-10> Marks (each)

20PEB305					Advanced Drilling					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	0	3	3	25	50	25	--	--	100

COURSE OBJECTIVES

- The course aims to provide students with a fundamental understanding of petroleum well drilling procedures on offshore with an inclination of well or directional drilling, its mechanics, and design methodology.
- To give information about a well control method for all the well (onshore, offshore, horizontal, vertical and directional well) and its procedures.

UNIT 1 Directional Drilling **10 Hrs.**

Directional Drilling Technology, Objectives of Directional Drilling. Tools for deflection & orientation. Directional well profiles and well path – deflection & corrections Motor Types: PD motors and Turbo drills; their description, power calculations and applications. Directional drilling problems & their remedies. Auto and Verti-track systems: Rotary steerable motors and geo-steering tools.

10 Hrs.

UNIT 2 Horizontal Well Drilling

Horizontal Well Drilling, Introduction of Horizontal well drilling: objectives & selection, drilling techniques and different well profiles, special mud requirements and their characteristics. Measurements While Drilling: objectives, MWD / LWD tools, Telemetry system and data interpretation Well Surveying: Objectives & methods. surveying analysis & calculations for well coordinates, multilateral

10 Hrs.

UNIT 3 Special Drilling Techniques

Coil tubing drilling principles and applications, Slant drilling, Laser drilling, Drilling problems and Case studies

UNIT 4 Well Control Principles& Procedures **9 Hrs.**

The Anatomy of a KICK, Kicks - Definition, Kick Control (a) Dynamic kick control (b) Other Kick control methods- Driller & Engineer methods of kick control.

Max. 39 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Demonstrate the understanding of different methods of directional drilling.
CO2: Apply the fundamentals of Horizontal well drilling techniques.
CO3: Execute the Measurement While Drilling and Logging While Drilling processes.
CO4: Evaluate the economics involved in Directional, Horizontal and Multilateral Wells.
CO5: Execute the special drilling methods viz. underbalanced, HP-HT, re-entry, extended reach, multilateral, slim-hole and coil tubing drilling method.
CO6: Critically evaluate the selection of rig for Slant hole drilling.

TEXT/REFERENCE BOOKS

1. Bourgoyne , Adam T. Jr., Martin E. Chenevert, Keith K. Millheim and F.S. Young Jr., Richardson, TX (1991) Applied Drilling Engineering, Society of Petroleum Engineers.
2. Joshi, S. D. (1991) Horizontal Well Technology, Penn Well Publishing.
3. Adam, N. J. (1980) Well control Problems and Solutions. Petroleum Publishing Company
4. Baker, R. (1998) A Premier of Offshore Operations Petroleum Extension Service, Division of Continuing Education, University of Texas at Austin in cooperation with International Association of Drilling Contractors, Houston, Texas.
5. Robinson, T (1992) The Offshore: An Introduction to the Technology, terminology and operations of offshore oil Exploration

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

Part A/Question: <Short Notes, Problems, Numerical> <5-7 > Marks (each)

Part B/Question: <Justification, Criticism, Long answers, Interpretation > <8-10> Marks (each)

Pandit Deendayal Energy University
Department of Petroleum Engineering, School of Energy Technology

20PEB306P					Introduction to Petroleum Software					
Teaching Scheme					Examination Scheme					
					Theory			Practical		Total
L	T	P	C	Hrs/Week	MS	ES	IA	LW	LE/Viva	Marks
0	0	2	1	2	-	-	-	50	50	100

COURSE OBJECTIVES

- To provide an overview of software tools used in the oil and gas industry
- To provide the importance of modelling and simulations for different petroleum engineering problems
- To explain how to identify the best tool matching the type and scope of the numerical study

List of Experiments:

Experiment 1: Developing Analytical Model using Buckley Leverett Solution.

Experiment 2: Developing Numerical Model for One Dimensional Flow through Porous Media Problem.

Experiment 3: Reservoir Modelling and Simulation Using IMEX/GEM/tNavigator.

Experiment 4: History Matching Problem

Experiment 5: Integrated Static and Dynamic Modeling using tNavigator

Experiment 6: Introduction to Well Testing using Saphire/Topaze/ Emeraude

Experiment 7: Design of Hydraulic fractures for Mini-frac and fracture applications using FracPro.

Experiment 8: Introduction to Integrated Production Modeling Suite.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1: Demonstrate the role of simulation software in the engineering industry and in specific to the upstream petroleum industry

CO2: Classify the various software tools available in the individual domain of upstream petroleum industry like seismic data processing and interpretation, reservoir modelling and simulation, drilling and production engineering.

CO3: Build a reservoir simulation model using CMG (reservoir simulation software) and simulate the specific initial andboundary constraints defined.

CO4: Excel the fundamental modelling workflows associated with the simulation software like conceptualizing, mathematical modelling, numerical modelling and solving the set of equations using the gauss elimination technique.

CO5: Comprehend complex and dynamic nature of the petroleum engineering problems and formulate a solution strategyfor effective management at the field scale.

CO6: Identify the best tool matching the type and scope of the numerical study the student has been deployed to perform inthe future.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

PART A: Evaluation Based on the class performance and Laboratory book **50 Marks**

PART B: Viva Examination based conducted experiments **50 Marks**

20PEB308P					Petroleum Engineering Practical – I					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
0	0	2	1	2	-	-	-	50	50	100

COURSE OBJECTIVES

- To provide basic knowledge related to petroleum engineering laboratory equipment.
- To teach the fundamental aspects of petroleum engineering, which includes: core plug making, core trimming and swabbing.
- To determination of permeability and porosity of the core sample by the different-different method and compared with each other for the research point of view.

LIST OF EXPERIMENTS:

Week 1: Make Core Plug ready for Experiment in Core Plugging
Week 2: Core Trimming and Swabbing
Week 3: Determination of Effective porosity of given core sample by saturation method.
Week 4: Determine the Permeability of given sample by using Ruska Liquid Permeameter
Week 5: Permeability measurement by using Gas Permeameter
Week 6 and Week 7: Study the petrophysical properties of core in core flooding apparatus
Week 8: Determine the viscosity of oil by using capillary viscometer.
Week 9: Drilling Equipment
Week 10: Sucker Rod Pumping System: A Case Study
Week 11: Study the working of Gas Lift system.
Week 12: Understanding of GGS System

COURSE OUTCOMES

On completion of the course, student will be able to

CO1: Understand and demonstrate core preparation techniques for various core flooding environments.
CO2: Determination of the petrophysical properties.
CO3: Design of enhanced oil recovery experiment using core flooding apparatus.
CO4: Determination of viscosity of light oil samples.
CO5: Demonstration of drilling equipment and production process
CO6: Demonstration of artificial lift equipment.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

PART A: Evaluation Based on the class performance and Laboratory book **50 Marks**

PART B: Viva Examination based conducted experiments **50 Marks**

20PEB309					Industrial Orientation					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
0	0	4	2	2	--	--	--	50	50	100

COURSE OBJECTIVES

- **The objective of the course is to orient students towards entire spectrum of the Oil and Gas Industry best working practices.**

Industrial Orientation

The students are required to visit entire value chain of the oil and Gas industry for

a) Acquaintance with the best working practices adopted in industry
b) To understand Industry working environment

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 – Acquire Technical skills prevailing in the industry,
CO2 – Develop professional communication skills (both written and oral).
CO3 – Demonstrate capability for understanding project plan and project management techniques.
CO4 – Demonstrate capability for managing team and working as team leadership.
CO5 – Develop Professional vision to chart its own professional life.
CO6 - Develop skill sets of professional and ethical petroleum engineering practices.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

PART A: Evaluation Based on the Individual performance during Industrial orientation **50 Marks**

PART B: Viva Examination based acquired knowledge **50 Marks**

20PEB322					Surface Production Operations					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
2	0	0	2	2	25	50	25	--	--	100

COURSE OBJECTIVES

1. To provide the understanding of production system and operations
2. Explain the classification and working principle of various types of equipment (e.g. separators, storage facilities etc.) used in production operations and transportation.
3. To provide an overview of the difference between onshore and offshore productions and processing system

UNIT 1 Separation and Treatment of produced fluid **7 Hrs.**

Classification of separators, Components of separator, Types of separator, Liquid level control and relative advantages / disadvantages of different types of separators, Dehydration & Desalting of Oil, Demulsification, Effluent Treatment, and Design of Separator.

UNIT 3 Storage and Transportation of Oil and Gas **6 Hrs.**

Storage tank for Oil, storage of LPG, Underground storage, Measurement-metering of Oil and Gas

UNIT 2 Surface facilities for Production System **7 Hrs.**

Group Gathering Station, Central Tank farm, Feeder and Trunk pipeline system,

UNIT 4 Flow assurance and Mitigation **6 Hrs.**

Scale & Paraffin Deposition and their Mitigation, Flow improver (Pour point depression and Drag reducer, heat treatment), pigging in pipe lines.

Max. 30 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1: Demonstrate the understanding of different types phase separator and application of these separators for efficient separation of gas, oil and connate water.

CO2: Apply the fundamental principles of operation of demulsification, dehydration and desalting of oil.

CO3: Understand wide range of produced fluid volume measurement and metering devices for oil and gas.

CO4: Specify the material of construction of storage tanks for oil and equipment used to storage of LPG on surface and subsurface.

CO5: Analyse the various transportation systems for oil and gases to understand difficulties of transportation to make use of flow improvers and other techniques to avoid pigging in the pipes.

CO6: Design of Separators, Storage tanks and Pipelines and to understand the effect of design parameters.

TEXT/REFERENCE BOOKS

1. Arnold Ken and Stewart Maurice, Surface Production Operations Vol-I and II.
2. ChillangarianG V, Surface Operations in Petroleum Production.
3. Huges J R and Swindles, Storage and Handling of Petroleum Liquids.
4. Alex Marks, Petroleum Storage Principles.
5. Handbook of Offshore Engineering, vol.2, S K Chakrabarti.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

Part A/Question: <Details> <> Marks

Part B/Question: <Details> <> Marks

23PEB303T					Reservoir Modelling and Simulation					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hours/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/VIVA	
3	0	0	3	3	25	50	25	--	--	100

COURSE OBJECTIVE:

1. To provide an overview of reservoir simulation software to conceptualize the complex nature of the reservoirs
2. To provide the concepts on how to create an algorithm to solve the model by applying numerical methods using the developed mathematical model & numerical model
3. To explain how to apply the conceptual, mathematical and numerical skills attained on field-scale problems; and classify limitations of the conventional techniques

UNIT 1 Reservoir Modelling **9 Hrs.**

Introduction to Modelling – Geological Modelling, Types of Model & designing of various models depending on reservoir complexities, rock properties, fluid properties etc., Concept of Black Model and Compositional Model.

UNIT 2 Reservoir Simulation **9 Hrs.**

Introduction, Historical Background, Application of Simulator, Conservation of Mass and Momentum; Continuity Equation, Equation of Motion, Darcy and Non-Darcy Flow; Flow Conditions: Single phase, two phase & multiphase equations for one two- & three-dimensional models Special Concept: Finite difference, Explicit & implicit grid system, Matrix solution, iterative method.

UNIT 3 Data Preparation **9 Hrs.**

Pseudo functions, Reservoir Model Solution Techniques: Implicit pressure and Explicit Saturation (IMPES); Implicit pressure & Implicit Saturation (IMPIS), Preview of Numerical Solution Methods: Direct & Iterative method, stability criteria, Well Representation.

UNIT 4 History Matching **9 Hrs.**

Model validation/verification: History Matching, Optimization algorithms in History Matching, performance prediction; Introduction to reactive transport modelling; Introduction to streamline simulation, comparison of conventional / streamline simulation.

Max. 36 Hrs.

COURSE OUTCOMES:

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

CO1: Apply the fundamentals of reservoir modelling and simulation

CO2: Differentiate between Black oil and compositional model for its application in reservoir engineering

CO3: Create Reservoir simulation models for various scenarios for visualization and implementation

CO4: Analyse and assess the required reservoir data for understanding the fluid flow in the reservoir

CO5: Validate the History matching concept for reservoir performance and production optimization.

CO6: Examine the robustness of reservoir model for performance prediction of oil and gas field reservoirs.

Text & Reference Books:

1. Crichlow, H. B. (1977) Modern Reservoir Engineering, A Simulation Approach, Prentice-Hall.
2. Franchi, J R. (2006) Principles of Applied reservoir Simulation, 3rd Edition. Gulf Professional Publication.
3. Aziz, K and Sattari, A (1979) Petroleum reservoir simulation, Applied Science Publishers
4. Peaceman, D. W. (1977) Fundamentals of numerical reservoir simulation, Elsevier Publication.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

Part A/Question: <Short Notes, Problems, Numerical> <5-7 > Marks (each)

Part B/Question: <Justification, Criticism, Long answers, Interpretation > <8-10> Marks (each)

20PEB324					Big Data Analytics and Internet of Things in Upstream Oil and Gas Industry					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
2	0	0	2	2	25	50	25	--	--	100

COURSE OBJECTIVES

- Develop an understanding of the big data in oil and gas upstream industry
- Improve skills for handling and processing big data of the whole upstream oil and gas upstream industry.
- Enhance knowledge base of IoT applications in Oil and Gas upstream industry
- Improve knowledge and skills to interpret data in a virtual environment for effective engineering operations and management

Unit I **Hours: 6**

Big Data Analytics: Big data definition, Big data methodology, Big data Processing

IoT: Definition of "IoT", IoT with reference to Oil and Gas upstream industry

Unit II **Hours: 6**

Big data in Upstream Oil and Gas Industry: Big data in exploration, Drilling, Reservoir Engineering and Production; Processing and application methodology.

Unit III **Hours: 7**

IoT in Upstream Oil and Gas Industry is fuelling productivity: Improvements through automation and AI for optimizing operation time, enhancing safety, maximize efficiency; 3D virtual modelling with Drone Technology, Video Surveillance technology,

Unit IV **Hours: 7**

Maximize Asset Performance and Enable People: Analysis big data with blockchain, Enable effective collaboration and efficient management to reduce unplanned downtime and increase asset utilization, Digital Transformation by Improving Workforce Productivity, cyber security measures.

Max <30 Hrs>

COURSE OUTCOMES

On completion of the course, student will be able to

CO1- Understand the big data and correlate it with the oil and gas upstream industrial activities.

CO2- Demonstrate an understanding of handling and processing big data of oil and gas upstream industry.

CO3- Demonstrate application of IoT in various areas of Oil and Gas upstream industrial activities.

CO4- Apply the knowledge and techniques of IoT for effective industrial operational activities.

CO5- Create logical algorithm for using IoT for monitoring and operational efficiency.

CO6- Analyse situation through interpretation of data of virtual environment for effective engineering operations and management

TEXT / REFERENCE BOOKS

1. Internet of Things and Data Analytics Handbook; Hwaiyu Geng Print ISBN:9781119173649 |Online ISBN:9781119173601 |DOI:10.1002/9781119173601; © 2017 John Wiley & Sons, Inc
2. Artificial Intelligence & Data Mining Applications in the E&P Industry (Digital Edition) Edited by Shahab D. Mohaghegh, Saud M. Al-Fattah, and Andrei S. Popa, 2011 Adobe® Digital Edition ISBN: 978-1-61399-064-3 Society of Petroleum Engineers
3. Applied Statistical Modeling and Data Analytics: A practical Guide for Petroleum Geosciences ; Srikanta Mishra and Akhil Datta-Gupta Elsevier
4. Harness Oil and Gas Big Data with Analytics: Optimize Exploration and Production with Data-Driven Models; KeithHholdaway, Wiley

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs.**

PART A: Part A/Question: <Short Notes, Problems, Numerical> **20 Marks**

PART B:<Justification, Criticism, Long answers, Interpretation > **80 Marks**

20PEB325					Artificial Lift Technology					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
2	0	0	2	2	25	50	25	--	--	100

COURSE OBJECTIVES

- Demonstrate the artificial lift techniques.
- Imbibe the knowledge of problems and their related remedies
- Improve skills to interpret the requirement of artificial lift
- Develop skill propose best suitable artificial lift solutions for low productivity wells

UNIT-1 **7 Hrs.**

Introduction to Artificial Lift Techniques: Principle and application consideration of artificial lift methods- Rod Pump (SRP/PCP), Gas Lift (Continuous/Intermittent), Electric submersible Pump (ESP), Hydraulic lifts (Jet Pump). Introduction to software's application for design and monitoring.

UNIT-2 **6 Hrs**

Sucker Rod Pump: working principles, Surface and Subsurface components of SRP, Designing, Monitoring and Optimization, Common Operating Problems and its mitigation. Software solution design and operating problems

UNIT-3 **6 Hrs.**

Gas Lift: working principles, Surface and Subsurface components of Gas Lift, Designing, Monitoring and Optimization, Common Operating Problems and its mitigation. Software solution design and operating problems

UNIT-4 **7 Hrs.**

Other Pumps (PCP, ESP, and Jet Pump) working principles, Surface and Subsurface components of Gas Lift, Designing, Monitoring and Optimization, Common Operating Problems and its mitigation. Software solution design and operating problems

Total = **30 Hrs**

COURSE OUTCOMES

On completion of the course, student will be able to

CO1- Relate artificial lift techniques with production enhancement.
CO2- Differentiate and illustrate the artificial lift techniques with its merits and demerits.
CO3- Apply the knowledge to solve artificial lift problems
CO4- Analyse a low productive well to predict suitable artificial lift.
CO5- Design artificial lift solutions for low productivity wells
CO6- Evaluate the feasibility of artificial lift design and recommend the best solution

TEXT / REFERENCE BOOKS

1. Dr. Guo Boyun, Computer Aided Petroleum Production Engineering
2. H Dale Begg, Production Optimization, OGCI Publication, Tulsa.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs.**
PART A: Part A/Question: <Short Notes, Problems, Numericals> **20 Marks**
PART B:<Justification, Criticism, Long answers, Interpretation > **80 Marks**

20PEB326					Offshore Operations and Engineering					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	0	3	3	25	50	25	--	--	100

COURSE OBJECTIVES

- Demonstrate the various offshore operations.
- Imbibe the knowledge of associated problems and their related remedies.
- Improve analytical skills to predict the suitable operation based on the offshore environment.
- Develop skill to propose best suitable strategy for performing offshore operation

UNIT-1 **10 Hrs.**

Introduction: Deep water facts & figures, Indian and Global Deep water exploration and production scenario, Introduction to Offshore, Environmental conditions, Wave, wind and undercurrent forces. Types and classification of Offshore Platforms. Offshore logistics.

UNIT-2 **9 Hrs**

Drilling and Well Completion: Techniques of drilling and completing in shallow water, associated problems, Techniques of drilling and completion in deep water, smart and intelligent well completion. Safety systems for offshore operations, Oil Processing in Offshore and Comparison with onshore.

UNIT-3 **10 Hrs.**

Deep water development & Flow assurance strategy, subsea completion, floating platforms, mooring and anchoring systems, ROV and ROT for well intervention. Flow assurance in deep water, prospective new technologies.

UNIT-4 **9 Hrs.**

Offshore Safety and fire protection: Safety aspects:-Process safety, Life extension, Well integrity, Rig interferences. Human factors and safety, ERR Process. Navigation aids, Fire protection system. Case history analysis and lessons learned

Total = **46 Hrs**

COURSE OUTCOMES

On completion of the course, student will be able to:

CO1- Relate Offshore operations with that of onshore operations.

CO2- Differentiate and illustrate offshore drilling and production platforms.

CO3- Apply the knowledge to tackle bottlenecks in offshore drilling and production operations.

CO4- Analyse offshore environment and predict techniques of various operation.

CO5- Plan strategy for offshore drilling and production operations.

CO6- Evaluate the feasibility of offshore operation in view with the offshore safety and environmental aspects.

TEXT / REFERENCE BOOKS

1. SSP singh, Jatin Agrawal and Nagmani (2019) Offshore operations and engineering, CRC Press, Taylor and francis group 281 p.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs.**

PART A: Part A/Question: <Short Notes, Problems, Numerical> **20 Marks**

PART B: <Justification, Criticism, Long answers, Interpretation > **80 Marks**

20PEB327P					Petroleum Engineering Practical – II					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
0	0	2	1	2	-	-	-	50	50	100

COURSE OBJECTIVES

- To train professional candidates capable of applying engineering principles and practices for the safe and efficient exploration, development, production, transportation and management of petroleum resources.
- To teach a student about rheological properties of any type of oil, slurry and chemical.
- To give knowledge about core flooding and hydrofracturing application in oil and gas industry.

Week 1: Determine the acid value of the given oil sample.
Week 2: Determine the Sulphur content of the given oil sample.
Week 3: Draw a ternary phase diagram for solubility of water benzene isopropyl alcohol (IPA) solution.
Week 4& 5: Determine the rheological properties of a given oil sample using Rheometer.
Week 6: Determine the particle size of the given oil sample using Zetasizer Particle Size analyser.
Week 7: Determine the Formation resistivity of the saturated rock sample.
Week 8: Water Coning using Resistance Analogy
Week 9: Understanding of Auto-Tensiometer
Week 10: Understanding of Proppant Conductivity System at normal temperature conditions.
Week 11: Understanding of Proppant Conductivity System at high temperature conditions
Week 12: Understanding of Formation Damage System with temperature conditions**.**
Week 13: Understanding of Formation Damage System without temperature conditions

COURSE OUTCOMES

On completion of the course, student will be able to
CO1: Determine crude oil property and its components.
CO2: Understand rheology and determine rheological properties for sample: Oil, Slurry, and Chemicals
CO3: Analyse the particle size distribution, interfacial tension, and solubility for any given fluid considering upstream and downstream applications.
CO4: Determine reservoir physical property and productivity index using an electrical analogy.
CO5: Evaluate proppant pack conductivity at different temperature conditions.
CO6: Understanding of formation damage at different temperature conditions.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

PART A: Evaluation Based on the class performance and Laboratory book **50 Marks**

PART B: Viva Examination based conducted experiments **50 Marks**

20PEB328P					Petroleum Product Testing Practical					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
0	0	2	1	2	-	-	-	50	50	100

COURSE OBJECTIVES

- To have the engineering knowledge of liquid petroleum products and their related repercussions.
- To analyse the problem related to storage, transportation and use of petroleum products.
- To recognize the design aspects related to distillation methods.
- Properties determination of the petroleum product properties and Understanding the petroleum product aromatic properties.

Week 1: Determination of Acid number of Fossils Oil Samples
Week 2: Determination of percentage purity of refinery products by Auto Distillation Apparatus.
Week 3: Determination of viscosity of a sample by Say Bolt Viscometer
Week 4: Determination of Smoke point and find the Luminosity Number of given samples.
Week 5: Determination of Calorific value of Coal, Lignite and Oil samples of different formation by Bomb Calorimeter.
Week 6: Determination of Flash & fire point of Refinery Products by semi-automatic Pensky & Martin apparatus.
Week 7: Determination of Flash & fire point b of Refinery Products by Cleveland open cup apparatus.
Week 8: Determination of Cloud point and Pour point of given samples.
Week 9: Determination of Aniline Point of a given samples of Refinery products
Week 10: Determination of Diesel Index of given samples
Week 11 Determination of Cetane Number of given samples of Refinery Products.
Week 12: Determine the moisture content of the given liquid fuel sample using dean and stark apparatus
Week 13: Determine the saponification value of given oil sample

COURSE OUTCOMES

On completion of the course, student will be able to

CO1: Preparing them to understand the experiments related to Midstream sector of oil and Gas refinery
CO2: Estimate the calorific value of crude oil sample by Bomb Calorimeter
CO3: Examine the flash and fire point of diesel and Kerosene oil.
CO4: Estimate the aniline point of refinery products to confirm the organic contents
CO5: Understand the Quality Assurance issues as per requirements of the industry practices.
CO6: Assess the distillation characteristics of refinery products such as gasoline, diesel & Kerosene by auto distillation apparatus.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**
PART A: Evaluation Based on the class performance and Laboratory book **50 Marks**
PART B: Viva Examination based conducted experiments **50 Marks**

20PEB329P					Personality Development and Communication Skill					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
0	0	2	1	-	-	-	-	50	50	100

COURSE OBJECTIVES

- To help the students in building vocabulary-based skills.
- To learn active listening and responding skills.
- To enhance team building and time management skills.
- To develop skills to communicate clearly.

UNIT 1

Self-Analysis: SWOT Analysis, who am I, Attributes, Importance of Self Confidence, Self Esteem. Creativity: Out of box thinking, Lateral Thinking. Attitude: Factors influencing Attitude, Challenges and lessons from Attitude, Etiquette. Motivation: Factors of motivation, Self-talk, Intrinsic & Extrinsic Motivators.

UNIT 2

Leadership: Skills for a good Leader, Assessment of Leadership Skills Decision Making: Importance and necessity of Decision Making, Process and practical way of Decision Making, Weighing Positive & Negatives.

UNIT 3

Interpersonal Skills: Gratitude Understanding the relationship between Leadership Networking & Team work. Assessing Interpersonal Skills Situation description of Interpersonal Skill. Team Work: Necessity of Team Work Personally, Socially and Educationally.

UNIT 4

Goal Setting: Wish List, SMART Goals, Blue print for success, Short Term, Long Term, Life Time Goals. Time Management: Value of time, Diagnosing Time Management, Weekly Planner To do list, Prioritizing work.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1: Make use of techniques of Grammar and Vocabulary.
CO2: Apply business etiquette skills effectively an engineer requires
CO3: Understand the importance of teamwork and Oral Communication
CO4: Apply the conceptual understanding of communication into everyday practice.
CO5: Develop written communication.

TEXT/REFERENCE BOOKS

1. SOFT SKILLS, 2015, Career Development Centre, Green Pearl Publications.
2. Covey Steven, Seven Habits of Highly Effective Teens, New York, Fireside Publishers, 1998.
3. Carnegie Dale, How to win Friends and Influence People, New York: Simon & Schuster, 1998.
4. Thomas A Harris, I am ok, You are ok, New York-Harper and Row, 1972
5. Daniel Coleman, Emotional Intelligence, Bantam Book, 2006
6. Robin Sharma A monk who sold his Ferrari, 1997.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

PART A: Evaluation Based on the class performance and Laboratory book **50 Marks**

PART B: Viva Examination based conducted experiments **50 Marks**

Teaching Scheme					City Gas Distribution (22PEB301T)					
					Examination Scheme					
L	T	P	C	Hours/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	0	3	3	25	50	25	--	--	100

COURSE OBJECTIVES

- To provide a fundamental understanding of the technical and business aspect of the City Gas Distribution network.
- To provide a fundamental understanding of the technical and business aspect of the City Gas Distribution network.
- To make students confident to implement the knowledge of City Gas Distribution in industry.

UNIT I: Introduction of Natural gas and its Value chain 10 Hr.

Properties of Natural Gas; Update on Gas Discoveries; Demand – Supply Gap; History of GCD in India; LNG, LPG, and CGD business.

Gas Value Chain**:** Gas Transmission and Distribution System; City Gate Station (CGS); Gas Filtration and Pressure reduction skids; Odorizing unit; Common pressure reduction station (CPRS)/District Regulation Station (DRS); Metering system; Pipeline for CGD network; Steel and PE Pipelines; CNG infrastructure: Mother Station, Online Station, Daughter Station, Daughter Booster Station; SCADA System

UNIT II: Regulatory Framework and Standards for City Gas Distribution 10 Hr.

Petroleum and Natural Gas Regulatory Board (PNGRB) era; Purpose, role, and functions of PNGRB; Challenges faced by PNGRB; Technical Standards including T4S.

UNIT III: Operation and Maintenance 10 Hr.

Annual O&M Plan; Steel Pipeline O&M (Cathodic Protection); Maintenance planning.

QHSE: CNG Safety; Emergency Response Plan; Disaster Management Plan; Quality assurance concepts;Inspection and Surveillance; Risk Assessment in CGD Business.

UNIT IV: Business Scenario 9 Hr.

CGD Business Scenario – India and Abroad; Profile of Major Players; Gas Pricing in CGD; Customer Service Issues in CGD Business; Innovations in CGD; Accelerators and Retarders of CGD business; CaseStudies – India and Abroad

Gas Retailing Business: Introducing Gas Retailing; Terminology used in CGD; Various components of CGD Network; CGD Business Segments; CGD Projects – Status in India; CGD Companies in India; Roleof CNG and PNG in Gas Distribution; CGD Economics

Max. 39 Hr.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1: Summarize City Gas Distribution value chain and Natural Gas system..
CO2: Acquaint and adapt the roles, functions and objectives of PNGRB
CO3: Explain Piped Natural Gas (PNG) distribution system.
CO4: Classify the types of Compressed Natural Gas (CNG) Stations and explain the CNG infrastructure.
CO5: Practice the HSE measures for safety of CGD sector.
CO6: Assess the steps to be taken in financing the CGD measures.

TEXT/REFERENCE BOOKS

1. Natural Gas: A comprehensive study (Anirbid Sircar and Kriti Yadav).
2. City Gas Distribution: An Indian perspective (Anirbid Sircar, Shreya Sahajpal, Umang Modi).
3. City Gas Distribution in India: Demystifying the Opportunity, Growth and Investment Potential(Infra line Energy)

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100	**Exam Duration: 3 Hr.**
Part A: 10 Questions each carrying 5 marks	50 Marks
Part B: 5 Questions each carrying 10 marks	50 Marks

20PEB330E					Seismic Sequence Stratigraphy					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
2	0	0	2	2	25	50	25	-	-	100

COURSE OBJECTIVES

- To define the genetic reflection packages by the surfaces that envelope seismic sequences and systems tracts.
- To recognize geological information embedded and concepts of Sequence Stratigraphy and Interpret Seismic data and observations, and fitting them to a larger context of Hydrocarbon Exploration

UNIT 1 Methods of sequence stratigraphic analysis **6 Hrs.**

Facies analysis using outcrops, core and model analogues; Well Logs; Seismic data's and age determination techniques, System Tracts; High stand system tract, Falling- stage system tract, Low stand system tract, Transgressive system tract, Regressive systems tracts.

UNIT 2 Sequence Models **6 Hrs.**

Types of stratigraphic sequences, sequences in fluvial systems, sequences to coastal to shallow water Clastic systems, sequences in deep water Clastic systems

UNIT 3 Seismic attributes in understanding sequences **8 Hrs.**

Horizon and Formation attributes (Time derived attributes, coherence, Post stack amplitude attribute, Frequency derived attributes, Spectral attributes), Visualization of Horizon attributes.

UNIT 4 Depth Conversion of Sequence attributes **6 Hrs.**

Sources and computation of velocities, general consideration in depth conversion, depth conversion using single velocity function, depth conversion using mapped velocity function

Max. 26 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1: Able to apply fundamentals of Geophysical techniques to recognize geological information embedded within seismic
CO2: Able to reconstruct and interpret chronostratigraphic charts, sea level curves, and seismic facies maps.
CO3: Apply knowledge of sedimentary depositional system/Sequence Stratigraphy for predicting reservoir architecture and seal potential of the basin.
CO4: Able to interpret clastic and carbonate depositional system processes and its affect upon reservoir architecture and seal potential for hydrocarbon exploration.
CO5: Application of key terms and concepts of Sequence Stratigraphy and Interpret Seismic data and observations, and fitting them to a larger context of Hydrocarbon Exploration
CO6: Systematically reconstruct basinal geohistory for its petroleum system analysis and effective hydrocarbon exploration.

TEXT/REFERENCE BOOKS

1. Principles of Sequence Stratigraphy, By- O. Catuneanu
2. Interpretation of Three- dimensional seismic Data- Sixth Edition, By Alistair R. Brown

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

Part A/Question: <Short Notes, Problems, Numerical> <5-7 > Marks (each)

Part B/Question: <Justification, Criticism, Long answers, Interpretation > <8-10> Marks (each)

20PEB331E					Pipeline Engineering					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
2	0	0	2	2	25	50	25	--	--	100

COURSE OBJECTIVES

- Fundamental knowledge and understanding of industry terms and acronyms
- Deeper insight between design basis, fluid properties
- Comprehensive understanding of specifications and specialties of various valves
- Fundamental knowledge and understanding of corrosion and its preventions

UNIT 1 **6 Hrs.**

Modes and comparison among different modes of transportation of petroleum products, Advantages and limitations of pipelines modes, Introduction to pipeline project, Economics and cost structure of Pipeline project, Economic pipe diameter.

UNIT 2 **7 Hrs.**

Introduction to outline for Design & construction of onshore-offshore pipelines, Pipeline codes and standards, Overview of O & G field Processes, Types of Onshore/ Offshore Pipelines, Factors affecting pipeline design (External, fluid properties, pipeline parameters and Fluid flow considerations. Loop- lines

UNIT 3 **7 Hrs.**

Design of Liquid pipelines: Hydraulic Analysis, Relevant Pipeline Parameters, Types of fluids, Pressure Loss calculations, Maximum allowable operating Pressure, Pipeline sizing, Diameter sizing, Determination of wall Thickness, Station Spacing Pumping Power calculations, Design of Gas Pipelines: Factors affecting Gas Pipeline Design, Pressure Loss calculations, Gas pipeline Hydraulic Calculations, as Compression / Power requirement.

UNIT 4 **6 Hrs.**

Commissioning of pipeline. PipelineOperations, Pigging, integrity assessment by Intelligent pigging and Instrumentation, Monitoring and Control Thru SCADA application, Corrosion and control/ Cathodic Protection.

Max. 26 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1: Understand the basics of pipeline, roles and responsibilities of a pipeline engineer in the oil and gas Industry

CO2: Apply pipeline codes, regulations and standards in both offshore and onshore environments.

CO3: Attribute pipeline terminology, various components and materials used and the fluid properties that affect pipeline transportation.

CO4: Evaluate forces acting on a pipeline system in operating conditions.

CO5: Analyse the processes involved in the prevention of corrosion and the inspection of pipeline and its components.

CO6: Adapt to various safety issues and practices involved in onshore and offshore pipeline operations.

TEXT/REFERENCE BOOKS

1. Alkazraji Duraid, (2008) A quick guide to pipeline engineering WOODHEAD Publishing Limited
2. Vincent, Jecqes (2010) Fundamentals of Pipeline Engineering, Gulf Publishing
3. Antaki, G. A. (2003) Piping and Pipeline Engineering, Marcell Dekker.
4. Modelling of oil and products and gas pipeline transportation by Mikhail V Luric
5. Pipeline Engineering by Henry Liu

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

Part A/Question: <Short Notes, Problems, Numerical> <5-7 > Marks (each)

Part B/Question: <Justification, Criticism, Long answers, Interpretation > <8-10> Marks (each)

20PEB332E					Corrosion Studies in Petroleum Industry					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
2	0	0	2	2	25	50	25	--	--	100

COURSE OBJECTIVES

- To acquire the basic concept of corrosion mechanism and forms of corrosion
- To acquire the concept of corrosion testing
- To acquire the concept of the modern theory of corrosion
- To understand the basic mechanism and procedure of corrosion testing and prevention

UNIT 1 **7 Hrs.**

Corrosion fundamentals, Corrosion in oil Industry, Cost of corrosion in the industry, Corrosivity of hydrocarbon fluids:- Water-oil emulsion and multiphase flow regime, Wettability of metal surface., Corrosivity of aqueous phase in hydrocarbon fluids; Sulphur and H2S in hydrocarbon fluids; Influence of oil chemistry on the Corrosivity of the aqueous phase. Pipeline corrosion; Kinetics of electrochemical surface reactions; Cathodic reduction reactions; Anodic dissolution reactions; Transport of species; Transport from the bulk solution to the steel surface; Transport through the porous surface scales. Corrosion products; Kinetics of corrosion products precipitation and corrosion products growth;

UNIT 2 **7 Hrs.**

Modes of internal corrosion attack: -Uniform corrosion; Localized corrosion ; Pitting corrosion; Erosion corrosion; Galvanic corrosion; Intergranular corrosion; Stress corrosion cracking; Hydrogen damage; hydrogen embrittlement; Hydrogen-induced cracking; Formation of hydride. Pipeline flow Corrosivity: Effect of water wetting; Effect of multiphase flow regime; Effect of multiphase velocity ; Effect of water phase characteristics; Significance of salinity; Significance of CO2 pressure; Significance of H2S; Significance of O2; Significance of pH; Effect of temperature. Materials selection:-Significance of alloying composition; Significance of steel microstructure.

UNIT 3 **6 Hrs.**

Experimental setups, methods, and standards:- Multiphase flow loop; Autoclave; Horizontal rotating cylinder; High velocity rig; Glass cell; Goniometer/Tensiometer ; Moisture content measurements ; Slow strain rate test. Corrosivity and corrosion rate determination:- Weight loss measurements; Potentiodynamic polarization and polarization resistance; Electrochemical impedance spectroscopy; Potentiostatic polarization;

UNIT 4 **6 Hrs.**

Pipeline Corrosion control; Environment control; Gas-phase contaminants and degasification; Water presence and dehydration/dewatering; Pipe cleaning; Pigging; Internal coating/liner; Chemical treatment and corrosion inhibitors:-Corrosion control by industrial inhibitors, Application methods; Influence of operating conditions; Solubility, partitioning, and compatibility. Biocides

Max. 26 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO-1: understand the basic mechanism of corrosion process
CO-2: classify corrosion into different types and forms
CO-3: illustrate the influencing factors of pipeline corrosion
CO-4: demonstrate the procedure of corrosion testing
CO-5: explain the modern theory of corrosion based on thermodynamic and kinetics study
CO-6: interpret the preventive measures of corrosion in oil and gas industry

TEXT/REFERENCE BOOKS

1. Papavinasam, S (2013) Corrosion control in oil and gas industry, Elsevier.
2. Cicek, Volkan. "Corrosion in Petroleum Industry." Cathodic Protection: Industrial Solutions for Protecting Against Corrosion: 231-245.
3. Nathan, Charles Carb. "Corrosion inhibitors." C. C. Nathan, Editor, published 1973 by NACE, 260 (1973).

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

Part A/Question: <Short Notes, Problems, Numericals> <5-7 > Marks (each)

Part B/Question: <Justification, Criticism, Long answers, Interpretation > <8-10> Marks (each)

23PEB302T					Unconventional Hydrocarbon Energy Resources					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
2	0	0	2	3	25	50	25	--	--	100

COURSE OBJECTIVES

- To provide basic knowledge related to unconventional energy resources, its properties and its exploitation techniques.
- To familiarize students with the unique aspects of unconventional gas and oil reservoirs, including their (1) resources and economic significance (2) geologic occurrences, (3) controls on production rates, (4) drilling and completion practices, (5) reservoir management, and (6) present activity

6 Hrs.

UNIT 1 Introduction: Energy Facts

Global vis-à-vis Indian energy scenario – demand and supply, and future projection; relation between GDP and energy demand; introduction to conventional, unconventional, renewable, non-renewable energy resources in general, and unconventional hydrocarbon energy resources in particular; climate – Keeling curve; clean and sustainable energy resources; comparison between formations and mode of occurrences of various conventional and unconventional energy resources.

7 Hrs.

UNIT 2 Oil Shale, Shale Gas, and Tar Sand

Oil Shale: Definition and prospect, geological conditions for formation of oil shale, oil shale recovery technology, ex-situ and in-situ extraction processes of shale oil, various retorting processes, processes leading to maximization of shale oil production; Shale Gas: Definition and prospect, the conditions of formation of shale gas, debate over extraction of shale gas from the subsurface, environmental issues, American experience, Marcellus shale gas project – an example of success story of shale gas exploitation, methods of production, hydrofracturing, composition of fracking fluid, water management, shale gas – Indian perspective; Tar Sand: Definition and prospect, distinction between heavy oil and bitumen, mineralogy and properties of oil sand, elemental composition and properties of bitumen, methods of recovery of bitumen by mining and advanced in-situ processes.

6 Hrs.

UNIT 3 Gas Hydrate

Definition, History of Hydrate R&D, prospect, types of methane hydrate deposits, chemistry and structure of natural methane hydrate, Necessary Conditions for Methane Hydrate Formation, typical conditions of methane hydrate formation in nature vis-à-vis different gas hydrate stability zones, physical properties of hydrates and ice, geology of methane hydrates, exploration for methane hydrates – geological, geochemical and geophysical, gas hydrate – Indian perspective.

7 Hrs.

UNIT 4 Introduction to Coal Bed Methane

Definition and prospect, CBM, CMM, and AMM; an Overview on CBM vs. Conventional Reservoir –Gas Composition, Adsorption, Water Production, Gas Flow, Rock Physical Properties, Gas Content, Coal Rank, Gas Production. Fundamentals of Coal Geology: Genesis of Coal; Major Stratigraphic Periods of Coal Formation; Gondwana and Tertiary Coals of India; Influence of Coal Properties; Coal Chemistry – Molecular Structure, Macerals, Lithotypes, Functional Groups, Proximate Analysis, Ultimate Analysis; Significance of Rank – Definition and Measurement, Vitrinite Reflectance Measurement, Physical Properties, Volatiles Generated, Micropores; Cleat System and Natural Fracturing. Sorption: Principles of Adsorption – different types of isotherms, Langmuir Isotherm, Methane Retention; Effects of Ash and Moisture on Methane Adsorption. Decline Curves. Hydraulic Fracturing of Coal seams:

Max. 26 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- **CO1** - Understand the present global energy scenario, future need and various unconventional hydrocarbon resources
- **CO2** - Analyse the Geomechanical properties of unconventional reservoirs
- **CO3** - Outline the fundamental of hydraulic fracturing
- **CO4** - Characterize the unconventional reservoirs and discuss available production methods
- **CO5** - Apply safety and environmental features in hydraulic fracturing, gas production, and water production
- **CO6** - Critical-thinking and problem-solving approach towards unconventional resources and recovery

TEXT/REFERENCE BOOKS

1. Zou, C et al (2013) Unconventional Petroleum Geology, Elsevier;
2. Max, M. D. (2003) Natural Gas Hydrate in Oceanic and Permafrost Environments, Kluwer Academic Publication;
3. Nash, K. M. (2010) Shale gas Development, Nova Science Publishers, Incorporated;

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

Part A/Question: <Short Notes, Problems, Numerical> <5-7 > Marks (each)

Part B/Question: <Justification, Criticism, Long answers, Interpretation > <8-10> Marks (each)

20PEB401					ADVANCED PRODUCTION ENGINEERING AND MANAGEMENT					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hours/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	0	3	3	25	50	25	-	-	100

COURSE OBJECTIVES

- Demonstrate the concepts of Production enhancement.
- Develop skills to predict bottlenecks and optimize production system.
- Develop Skills to design Stimulation Jobs
- Imbibe the knowledge of offshore Safety and fire protection.

Unit I **Hours: 12**

Production Enhancement: Introduction: An overview of various production enhancement techniques, Well Analysis and Remedial Measures, Low Productivity – Stimulation, Excessive Production of unwanted fluid, Water Control, Sand Control, Production Optimization

Unit-II **Hours: 8**

Stimulation: Concept of Formation damage, Type & description of stimulation techniques to mitigate formation damage problem and address issues of low productivity, Design of matrix acidization and acid fracturing. Design of hydraulic fracturing, Multistage fracturing.

Unit III **Hours: 14**

Control of Excessive Production of unwanted fluid: Reasons for excessive production of oil & gas, Causes and hazards of excessive sand production. Industry practices to contain their production. Water Control techniques-Reasons, identification and control techniques, Sand Control Techniques Reasons, identification and control techniques

Unit IV **Hours: 5**

Production optimization: Modelling, Monitoring and Control, optimization processes.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1- Regulate formation damage and find alternative methods to bring the well into production again.

CO2- Analyze the fundamentals of productivity index and future IPR and understand the principles of production optimization

CO3- Explain properly the principles of sucker rod pump, gas lift system, progressive cavity pump and electrical submersible pump.

CO4- Determine the bottom-hole pressure, well head pressure, and handling oil and gas flow rates of hte reservoir.

CO5- control in case of any calamity during installations at drilling or production.

CO6- Evaluate the understanding of water control and sand control.

TEXT / REFERENCE BOOKS

1. Dr. Guo Boyun, Computer Aided Petroleum Production Engineering
2. H Dale Begg, Production Optimization , OGCI Publication, Tulsa.
3. Deep water Petroleum Exploration & Production-By Willium Leffler, Richard Pattardozzi, Gordon Sterling
4. Floating Production System- By N.K. Mitra.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs.**

PART A: Part A/Question: <Short Notes, Problems, Numericals> **20 Marks**

PART B:<Justification, Criticism, Long answers, Interpretation > **80 Marks**

20PEB402					INTEGRATED RESERVOIR MANAGEMENT					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hours/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	0	3	3	25	50	25	-	-	100

COURSE OBJECTIVES

- Demonstrate the concepts of Reservoir management in oil and gas exploitation
- Imbibe the knowledge of reservoir engineering in E & P business.
- Develop Skills to analyse reservoir behaviour and monitoring plan for reservoir management.
- Develop skills to implement best reservoir management practices.

Unit I **Hours: 10**

Reservoir Management Concept & Process: Definition, history & fundamentals of reservoir management, synergic team approach; Integration of geosciences and engineering for reservoir development, development plans, surveillance & monitoring, Evaluation, Revision of plans & strategies.

Unit II **Hours: 10**

Reservoir Data & Model & Performance Analysis: Reservoir Data types: Geosciences, seismic & engineering, Data validation & Integration, Application for Reservoir Model building, Reservoir Performance analysis by various methods: Volumetric, decline curve, material balance & simulation.

Unit III **Hours: 10**

Reservoir Management, Development Plans, EOR Concepts & Techno economic Evaluation: Developmental/redevelopment plans for newly developed and matured fields, Differentiation in cases of oil, gas and condensate reservoirs, Importance of improved recovery processes in achieving maximum recovery through development plans. Scenarios for development plans & Techno-economic evaluation. Risk, uncertainties & economic optimization.

Unit IV **Hours: 9**

Reservoir Case Studies & Conclusions

Reservoir Management case studies for various types of fields from both onshore and offshore, Importance of IRM. Current challenges and areas of further work.

Total: 39 Hrs

COURSE OUTCOMES

On completion of the course, student will be able to

CO1- summarize different types of oil and gas resources with different scenarios of determination methods

CO2- Integrate the fluid, Petrophysics and production data of a reservoir for analysing its static and dynamic performance.

CO3- Describe the concept of field development in distinct stages in the life cycle of a reservoir with input from reservoir modelling and simulation

CO4- Analyse the key issues for application of IOR/EOR methods in field development plan.

CO5- Conceptualize and implement reservoir management practices.

CO6- Prepare reservoir field development plan for favourable risked-techno-economic scenario.

TEXT / REFERENCE BOOKS

1. Integrated Petroleum Reservoir Management- A team approach: Abdus Satter & Ganesh C. Thakur; Penwell Publishing Company, Tulsa, Oklahoma.
2. Development of oil and gas fields: Dr. Sant Kumar; Allied Printers, Dehra Dun, 248001, India. Finar I.L., “Organic chemistry” Vol-I, 6th Edition, Pearson Education, 2002.
3. The practice of Reservoir engineering, L . P. Dake, Revised edition, 2006, Elsevier Publisher.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs.**

PART A: Part A/Question: <Short Notes, Problems, Numerical> **20 Marks**

PART B:<Justification, Criticism, Long answers, Interpretation > **80 Marks**

20PEB403					NATURAL GAS PROCESSING AND VALUE ADDITION					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hours/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	0	3	3	25	50	25	-	-	100

COURSE OBJECTIVES

- Demonstrate the concepts of Gas Processing.
- Demonstrate the Cryogenic processing of gases.
- Develop skills to plan processing required to meet market specification economically.
- Confidence to implement safe processing and handling of gases

Unit I **Hours: 10**

Introduction- Defining Gas processing, Historical background, General processes concerning gas Processing : Water and Hydro Carbon Liquid Separation, Dehydration, H2 S Removal and elemental Sulfur extraction, Carbon Di Oxide (CO_2) removal, Mercury Removal. Gas processing for pipeline transportation (Corrosion protection, limits for water, H_2S and CO_2 contents).

Unit II **Hours: 10**

Introduction to Refrigeration/ Cryogenic Process for separation / processing of Gases: Refrigeration Cycle, Cascade refrigeration processes (Multiple pure component system and Mixed Refrigeration system), Turbo Expander and System, Advanced Refrigeration system

Unit III **Hours: 10**

Extraction of components in Natural gas and /or liquids: Helium Extraction, Nitrogen Removal, Propane and Butane (LPG) Extraction, Ethane Extraction, NGL component extraction from NGL liquids by Fractionation process, NGL Extraction from Gas Mix, Introduction to use of natural gas liquid (NGL), its components for manufacture of value added products: C_2, C_3 and C_4

Unit IV **Hours: 9**

Gas processing for LNG Production (limits of Water, CO_2, H_2S and Mercury contents etc.), LNG Production process, LNG Storage, LNG Transportation & Regasification.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1- Gather comprehensive understanding and information about the LNG value chain.

CO2- Understand physical and chemical properties of LNG with processing techniques.

CO3- Assess techno-commercial factors involved in the development and operation of LNG regasification terminals and liquefaction processes

CO4- Understand LNG transportation and Ship handling at receiving terminals.

CO5- Enumerate global and domestic scenario and pricing of LNG.

CO6- Practice employee health and safety as well as adherence to required standards for safety and operations

TEXT / REFERENCE BOOKS

1. Gas Production Engineering by Sanjay Kumar
2. Handbook of Natural Gas Transmission and Processing by Saeid Mokhatab, William A Poe and James G. Speight

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs.**

PART A: Part A/Question: <Short Notes, Problems, Numerical> **20 Marks**

PART B :< Justification, Criticism, Long answers, Interpretation > **80 Marks**

20PEB404P					RESERVOIR ENGINEERING SOFTWARE					
Teaching Scheme					Examination Scheme					
					Theory			Practical		
L	T	P	C	Hours/Week	MS	ES	IA	LW	LE/Viva	Total Marks
0	0	4	2	4	--	--	--	50	50	100

COURSE OBJECTIVES

- To provide an overview of Professional/Industrial software tools used in the Reservoir Engineering Domain
- To provide the significance of Reservoir modelling and simulations for various Reservoir engineering problems

LIST OF EXPERIMENTS

Experiment 1: Seismic Data Loading, Visualization and Processing using Kingdom suite/ tNavigator.

Experiment 2: Petrophysical Investigations using Well Log Analysis.

Experiment 3: Development and validation of Geo-cellular Modelling using Geostatic prediction and Variogram Modelling.

Experiment 4: Fluid Property (PVT) Modelling for Black Oil or Compositional Oil Simulations.

Experiment 5: Introduction to Reservoir Simulation Modelling Workflows.

Experiment 6: Simulation of SPE Comparative Solution-Model 1 (SPE-9723-PA)

Experiment 7: Assisted History Matching using an Optimization Algorithm.

Experiment 8: Simulation of Enhanced Oil recovery Process

Experiment 9: Well Testing Studies using Kappa Engineering

Experiment 10: Fracture design, analysis and optimization using FracPRO.

Experiment 11: Hydraulic Fracture Treatment Design by using FracPro.

COURSE OUTCOMES

CO1: Demonstrate the role of Reservoir simulation software in the upstream Petroleum industry.
CO2: Classify the various software tools available in the Reservoir domain for history matching, performance and Risk analysis
CO3: Create a Static and Dynamic reservoir simulation model using simulation software's.
CO4: Excel the fundamental modelling workflows associated with the simulation software.
CO5: Comprehend complex and dynamic nature of the Reservoir engineering problems including Pressure transient analysis, hydrofracturing etc. and formulate a solution strategy for effective management at the field scale.
CO6: Identify the best tool matching the type and scope of the numerical study deployed to perform in the future.

TEXT / REFERENCE BOOKS

1. Software Manuals

END SEMESTER EXAMINATION
QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

PART A: Evaluation Based on the class performance and Laboratory book **50 Marks**
PART B: Viva Examination based conducted experiments **50 Marks**

20PEB407					Industrial Internship					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
0	0	4	2	2	--	--	--	50	50	100

COURSE OBJECTIVES

- **The objective of the course is to expose students towards specialised aspect of chosen Oil and Gas Industry working practices.**

Industrial Internship

The students are required to perform one month internship in the specialised aspect of chosen oil and Gas Industry

a) Acquaintance with the best working practices adopted in industry
b) To understand Industry working environment

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 – Develop Technical and Professional skills for employability in Oil and Gas industry,
CO2 – Develop professional communication skills (both written and oral).
CO3 – Acquire understanding of project planning management methods and techniques.
CO4 – Demonstrate capability of team leadership and Team building for solving industry problems.
CO5 – Develop Professional vision to chart its own professional life.
CO6 - Develop skill sets for professional and ethical petroleum engineering practices.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

PART A: Evaluation Based on the Individual performance during Industrial orientation **50 Marks**

PART B: Viva Examination based acquired knowledge **50 Marks**

23PEB401T					HYDROCARBON CONTRACTS AND ASSET MANAGEMENT					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hours/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
2	0	0	2	2	25	50	25	-	-	100

COURSE OBJECTIVES

- Demonstrate legal principles of oil and gas contracts
- Illustrate Marketing strategies in Oil industry
- Imbibe Portfolio Management skills in graduates
- Develop skills to address dispute in oil business

Unit I **Hours: 6**

Life cycle of Petroleum Project, Fiscal System in hydrocarbon industry (Progressive, regressive fiscal policy tax and non-tax components of Fiscal Policy), Basic elements of Contracts, Basic terminologies of contract and legal. Basics of Upstream and Downstream regulatory Laws and Policies, Fundamentals of Oil and gas accounting: Capex, Opex, Cost classification, Depreciation depletion and amortization (DDA), Cash flow, internal rate of return, Net Present value **Unit II** **Hours: 7**

Upstream Agreements (Concessionary, Production sharing, Risk sharing,), Indian policy on Hydrocarbon Exploration and Licensing Policy (HELP). Drilling Contracts, Farm-in and Farm-out, Joint ventures, Comingling allocation and attribution agreement, Gas sale and supply agreement. LNG Agreement

Unit III **Hours: 6**

Hydrocarbon trading-Oil trading, Physical and Paper; Crude oil Markets- Spot, Barter, Future and forward. Oil pricing mechanism, short term and long term Oil Pricing.

Unit IV **Hours: 7**

Asset Integrity Management Introduction to concept of Asset Management& Asset Integrity Management, The Asset Management System – Asset Management Policy – Asset Management Strategy – (Strategic) Asset Management Plans – line of sight; International standard on Asset Management: ISO 55000; Risk & Risk Assessment Approaches Used for Asset Integrity Management; Identification & assessment of risk; Risk management: using the risk matrix, risk register & hazard log; Risk Based Maintenance Deterioration: the way assets could fail the seven steps of Risk Based Maintenance (RBM) / Reliability Centred Maintenance (RCM) incl. Failure Mode Effects &Criticality Analysis; Failure behaviour of onshore & offshore systems.

Max Hrs : 26

COURSE OUTCOMES

On completion of the course, student will be able to

CO1- Master and comprehensively understand the legal principles of oil and gas contracts
CO2- Understanding in depth licensing, production sharing and service contracts
CO3- Identifying the risk factors and managing those risks through effective contractual clauses
CO4- Know the relevant legal and regulatory frameworks that are in the oil and gas industry
CO5- Learn how to use appropriate contractual clauses in oil and gas contracts
CO6- Appreciate the best dispute resolution methods and how it will apply it in different scenarios

TEXT / REFERENCE BOOKS

1. Shippey, K. C. (2009) A short course on international Contracts, 4 th Ed. World Trace press.
2. Tordo, S (2007) Fiscal System in Hydrocarbons: design issues. The World Bank
3. Ministry of P & G (Government of India) Model Production Sharing Contracts and HELP,
4. Johnston, D (1994) International petroleum fiscal system and Production sharing contracts, Penn Well books
5. Wright, C. J and Gallum, R. A. (2008) Fundamentals of Oil and Gas accounting 5th Edition Pennwell
6. Millar, M. P (2015) Asset Integrity management handbook
7. Jennings Anthony (2002) Oil and Gas Exploration contracts
8. Jennings Anthony (2002) Oil and Gas Production contracts
9. David M. R. (1999) Oil and Gas infrastructure and mid-stream agreement
10. David M. R. (1999) Natural gas Agreement

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs.**

PART A: Part A/Question: <Short Notes, Problems, Numerical> **20 Marks**

PART B:<Justification, Criticism, Long answers, Interpretation > **80 Marks**

23PEB403T					HEALTH, SAFETY AND ENVIRONMENT					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hours/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
2	0	0	2	2	25	50	25	-	-	100

COURSE OBJECTIVES

- Describe the various hazard associated with oil and gas industry.
- Demonstrate the requirement for safety
- Perform case studies on hazards and risk analysis
- Develop the skills to address Safety issue.

Unit I **Hours: 7**

Physical Hazards Noise, Heat, Vibration, Illumination, Radiation, extreme climatic conditions etc, Chemical Hazards Hydrogen sulfide gas, Hydrocarbons, Ammonia, Chlorine, Formaldehyde, Hydrochloric Acid, Methanol, Sulphur, Sulphuric acid, Sodium Hydroxide, etc. Biological Hazards, Psychological Hazards, Ergonomic Hazards, Injuries, Burns etc Prevention & Remedial controls of Occupational Hazards In Oil & Gas Industry for each type of Hazards Engineering Control, Administrative Control, Medical Control, Use of Personal Protective Equipment (PPE) Understanding Fire: Fire triangle/tetrahedron, Stages of development of fire Flammability, Concept of flash / Fire point, volatility, Flammable Limits, Fire Detection; Fire signature, Smoke, Heat, Flame, Combustible Gas Detection Fire Prevention, Fire suppression , Process Safety: Safety Analysis Table, Safety Analysis Checklist & SAFE Chart(ref API 14 C)

Unit II **Hours: 6**

Hazard & Risk Analysis

Risk Matrix, HAZID, HAZOP, QRA (API 14 J, OISD), Safe Work Practices: PTW, MOC, SIMOPS etc. (ref API RP 75, OISD, OMR), Electrical Safety; Classification of Hazardous locations, use of electricity I Hazardous area (Ref IER, OISD, OMR, API RP 500 & 14 F) Accident Investigations: Study of major Accidents like Piper Alpha, Flixborough, Bhopal etc., Investigation techniques Emergency Response planning Audits & Inspection. Audit methodology, protocol, typical check lists for Drilling rigs, Work over activities, logging, etc. (ref OISD Standards)

Unit III **Hours: 6**

HSE Management System

OISD, API RP 75, ISO 14000, ISO 9000, OSHAS 18000 Standards, OMR and Petroleum Rules (by PESO).

Unit IV **Hours: 7**

Environment

Environment Concepts: Effect on eco-system; Air, Water, & Soil of HC"s. Impact of Exploration & Exploitation of Hydrocarbon on Environment Environmental studies (Off shore & On Shore) - Environmental Impact Assessment Oil Spills Control and their management. State, Government of India and international Maritime Environmental Rules & Regulations. Drilling / Oil Storage / Effluent water / waste (solid & sludge) treatments their disposal and remediation of soil etc. **Upstream safety:** Implementing Agency OISD (for on-land blocks) Directorate of Mine Safety (for Off Shore Blocks), Safety in Rig operation; Safety in Exploration and Production. **Downstream Safety:** Implementing Agency PNGRB; Safety Regulations (Technical Standard, Specification and Safety Standards T4S), Emergencies, Mutual Aida; Emergency Response and Disaster Management Plan ERDMP)

Max. Hrs: 26

COURSE OUTCOMES

On completion of the course, student will be able to

CO1- Understand the various hazard associated with oil and gas industry.

CO2- Apply the control methods & safety measures for preventing hazards and risk.

CO3- Analyse the various risk matrixes, safe work practices and accident investigations.

CO4- Implement the standards of HSE management systems.

CO5- Evaluate the various environmental issues in oil and gas industry and safety regulations.

CO6- Demonstrate the various safety issues during drilling and refinery operations.

TEXT / REFERENCE BOOKS

1. Less, F. P., Loss Prevention in the Process Industries, 2nd ed., Butterworth Heinemann, UK.
2. Peavy, H. S., Rowe, D. R. and Tchobanoglous, G., Environmental Engineering, McGraw Hill, New York.
3. Sanders, R. E., Chemical Process Safety, Butterworth Heinemann, UK, Year.
4. NFPA, API 14 G & OISD Standards.
5. Marchell, V. and Ruchemann, S., Fundamentals of Process Safety, Institution of Chemical Engineers, Warwickshire, UK

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs.**

PART A: Part A/Question: <Short Notes, Problems, Numericals> **20 Marks**

PART B:<Justification, Criticism, Long answers, Interpretation > **80 Marks**

20PEB408E					ENHANCED OIL RECOVERY					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hours/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
2	0	0	2	2	25	50	25	-	-	100

COURSE OBJECTIVES

- Demonstrate the concepts of EOR.
- Evaluate performance analysis of field scale implementation of EOR.
- Develop skills to predict suitable EOR Scheme.
- Develop skills to plan EOR program

Unit I **Hours: 5**

Introduction to EOR processes: Definition, Difference of IOR and EOR, Target oil resource for EOR, General Classification. Description and potential of different EOR processes.

Unit II **Hours: 5**

Microscopic and macroscopic displacement of fluids in a reservoir, Displacement efficiency in different system – linear, areal, volumetric, Definition and discussion of mobility ratio and mobility control processes for different types of fluids

Unit III **Hours: 10**

Candidates for EOR processes and Selection Criteria Miscible/Immiscible displacement processes - water flooding, gas injection, micro-emulsion flooding Chemical Flooding - polymer flooding, Surfactant flooding, Micellar flooding related methods Thermal recovery processes- in situ combustion, hot-water injection, steam flooding, SAGD Microbial EOR. **Selection criteria for EOR:** Determination of residual oil (well test, reservoir performance, core analysis, cased /open hole logs, single well tracer), Laboratory studies, Field pilot test and evaluation, Techno economic feasibility, Full scale implementation, Monitoring and review

Unit IV **Hours: 6**

Global Scenario of EOR and Some Case Studies

Field scale implementation and their performance of various EOR schemes of local and global context.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1- Relate an EOR operation with their knowledge

CO2- Illustrate the need of EOR in oil field

CO3- Identify the effect of different EOR fluids on the recovery of reservoir

CO4- Analyse the feasibility of EOR

CO5- Design a plan to implement EOR

CO6- Validate EOR by performing Pilot studies

TEXT / REFERENCE BOOKS

1. Enhanced Oil Recovery, I –Fundamentals and analyses – E. C. Donaldson, G. V. Chilingarian, T. F. Yen (Edited) – Elsevier Science Publishers B. V. – 1985.
2. Enhanced Oil Recovery, II –Processes and operations – E. C. Donaldson, G. V. Chilingarian, T. F. Yen (Edited) – Elsevier Science Publishers B. V. – 1989.
3. Modern Chemical Enhanced Oil Recovery: Theory and Practice-James J. Sheng, Gulf Professional Publishing, Elsevier.
4. Enhanced Oil Recovery – D. W. Green, G. P. Willhite – SPE Textbook Series Vol. 6 -1998.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs.**

PART A: Part A/Question: <Short Notes, Problems, Numericals> **20 Marks**

PART B:<Justification, Criticism, Long answers, Interpretation > **80 Marks**

20PEB409E					PETROLEUM MANAGEMENT					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hours/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
2	0	0	2	2	25	50	25	-	-	100

COURSE OBJECTIVES

- Demonstrate the role of management in petroleum industry
- Illustrate Marketing strategies in Oil industry
- Imbibe Portfolio Management skills in graduates
- Develop skills for crisis management in oil business

Unit I **Hours: 06**

Petroleum management strategies Petroleum strategy, Industrial relation and labor law, Project management, legal aspects of business, management control system, business ethics, entrepreneurship, energy laws.

Unit II **Hours: 06**

Energy and Infrastructure Energy Economics, Business of Petroleum, Energy Trade and Risk management, Infrastructure for Marketing of Oil and Gas, Storage and products, Information system in energy value chain, supply chain and logistics management.

Unit III **Hours: 08**

Oil Marketing Consumer Behavior, Service Marketing, Strategic Brand Management, Marketing communication, Digital marketing, Retail management, Sales and Distribution management

Unit IV **Hours: 06**

Finance Management Investment Analysis and Portfolio Management, Oil and Gas projects financing, Derivative and Risk Management, Venture Capital and Private Equity.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1- Understand the role and responsibilities at the management level in the Petroleum industry

CO2- Able to learn main economic, market, physical, environmental and political forces driving energy demand, supply, and prices of Petroleum,

CO3- Analyse and appraise the economic aspects of the petroleum Industry

CO4- Appraise the economic-technical and social feasibility of an entire value chain of Petroleum Industry.

CO5- acquire ability to develop, manage and lead team for Planning, Controlling and managing Petroleum Projects

CO6- Justify the applied practical decisions and experienced the risk of doing business in the Oil & Gas industry on a worldwide scale

TEXT / REFERENCE BOOKS

1. The Global oil and Gas industries; Management, Strategy and Finance, 2011, Penn well Corporation Oklahoma USA, By- Andrew ink pen and Michael H. Moffett.
2. Oil Property Evaluation, By Robert S. Thompson

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs.**

PART A: Part A/Question: <Short Notes, Problems, Numericals> **20 Marks**

PART B:<Justification, Criticism, Long answers, Interpretation > **80 Marks**

20PEB410E					HYDROFRACTURING					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hours/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
2	0	0	2	2	25	50	25	-	-	100

COURSE OBJECTIVES

1. provides a background on the physical and mechanical characteristics of the unconventional reservoirs as compared to conventional ones
2. To apply stimulation methods to improve recovery from conventional reservoirs
3. To augment stimulation methods to increase recovery from the unconventional.

Unit I conventional vs Unconventional reservoirs **Hours: 5**

Comparison of conventional vs unconventional reservoirs, Geochemistry & Geomechanics properties relating radial and linear forms of Darcy's law to hydraulic fracturing, Near wellbore pressure drawdown and its significance, Inflow and Outflow performance with/without stimulation

Unit II Well Stimulation **Hours: 7**

Types of formation damage , Formation damage in Upstream and downstream areas, Sanding as formation damage and FracPacking, Types of stimulation methods, Acid wash, Matrix stimulation and hydraulic fracturing, Hydraulic fracturing applications , Hydraulic fracturing geometries for conventional vs unconventional reservoirs

Unit III **Hours: 7**

Geomechanics: Failure mechanisms and criteria – compressive, tensile, shear, creeping, pore collapse, plastic behaviour, Brittleness & ductility, Effective stress concept of the conductive elements; matrix, natural fractures, beddings, and induced fracture. Stress profile and fracture height containment, Mechanical Earth Model Stress shadowing effect, Understanding the critically stressed natural fractures & beddings and shearing effect Dynamic and static mechanical properties Stress field; measurement and estimation, Fracturing fluid rheology Fluid leakoff; fluid loss modeling, fluid shear history, Fracture conductivity, Acid vs. proppant fracturing, Proppant design; size, concentration, lb/ft,selection, Diagnostic techniques, Modeling a hydraulic fracture: Plain strain, elastic deformation, width development and fracture propagation, CGD, KGD, Fracpro, Gohfer, and new models for network fracturing

Unit IV **Hours: 7**

Major shale oil and shale gas basins, Well-pad configuration and horizontal wells, Horizontal wells placement and spacing, Sweetspot identification, Well completion: Multistage fracturing; plug & perf, ball-activated sliding sleeves, Fracturing stages, stages spacing and clusters spacing, Fracturing fluids; slick water fracturing, high viscosity friction reducer, Proppant selection: local sand, light weight proppant, hybrid in size or density, Minimizing footprint, Complex fracture modelling, Diagnostic methods: DFIT, microseismic, fiber sensing, and tiltmeter, Water management, Production optimization Refracturing: is it successful? candidate selection, procedures, economics and case histories. IOR/EOR techniques, Refracturing through diverter, Multistage fracturing Waterless fracturing; energetic fracturing, Pulse fracturing, Cryogenic fracturing, Exothermic chemical pulse fracturing, and laser perforation/fracturing

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 Apply basin understanding of Geomechanical properties to evaluate the reservoir

CO2 Evaluate the stress direction, Stress profile and fracture height for the Reservoir

CO3 To design suitable propants for the selected hydrofracturing job in reservoir.

CO4 Evaluate suitable candidate for Hydrofracturing/Refracturing/ and Multistage fracturing

CO5 Evaluate suitable Hydrofracturing models to be applied in specific reservoirs

CO6 Create suitable workflow for Hydrofracturing Job work for selected reservoir conditions.

TEXT / REFERENCE BOOKS

1. **Petroleum Well Construction, 1998, edited by Michael Economides, Larry Watters and Shari Dunn-Norman: Chapter 5: Rock Mechanics by Hazim Abass and Justo Neda. The chapter will be provided to the students.**
2. **Hydraulic Fracture Modeling, 2018, edited by Yu-Shu Wu: Chapter 14: Hydraulic Fracturing: Experimental Modeling by Hazim Abass and Chris Lamei. The chapter will be provided to the students.**
3. **Unconventional Oil and Gas Resources Exploitation and Development, 2016, by Usman Ahmed and Nathan Meehan**

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs.**

PART A: Question: <Short Notes, Problems, Numerical> **20 Marks**

PART B:<Justification, Criticism, Long answers, Interpretation > **80 Marks**

20PEB411E					FLOW ASSURANCE					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hours/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
2	0	0	2	2	25	50	25	-	-	100

COURSE OBJECTIVES

- Demonstrate the concepts of flow assurance.
- Illustrate the analytical tools for flow assurance.
- Enhance skills to analyse and interpret basic descriptive and inferential statistics.
- Develop skills to address flow constraints in oil fields.

Unit I **Hours: 6**

Definition of Flow assurance, Typical Production System, Criteria of flow assurance, Resistances to the flow, various issues encountered for flow assurance in the industry, Importance of velocity profiles, temperature profiles and concentration profiles in prediction flow assurance issues. Importance of Pressure drop calculations in flow assurance industry

Unit II **Hours: 8**

Definition of Slugging, Terminology used in slugging, Flow Pattern Maps and its utilization, Definition and criteria for terrain slugging and severe slugging, Remedies of slugging, terrain slugging and sever slugging, Liquid Loading definition, symptoms of liquid loading, Models used to predict liquid loading, Mitigation of Liquid Loadings

Unit III **Hours: 6**

Wax Deposition definition, Wax deposition Criteria, Models used to predict Wax deposition remedies and mitigation techniques for wax deposition, Definition of Gas Hydrates, Criteria for formation of Gas hydrates, Models utilized for prediction of gas hydrates, remedies and mitigation techniques of gas hydrates

Unit IV **Hours: 6**

Scale Deposition definition, Scale deposition Criteria, Models used to predict Scale deposition remedies and mitigation techniques for Scale deposition , Definition of Asphaletenes, Criteria for formation of Asphaltenes, Models utilized for prediction of Asphaltenes, remedies and mitigation techniques of Asphaltenes.

COURSE OUTCOMES

On completion of the course, student will be able to.

CO1- Recognise a Flow Assurance problem.

CO2- Illustrate the need for flow assurance problem mitigation.

CO3- Apply knowledge to understand problems in details.

CO4- Analyse the problem to know the root cause.

CO5- Plan a remedial activity unique to the flow assurance problem.

CO6- Recommend jobs to mitigate flow assurance problem.

TEXT / REFERENCE BOOKS

1. Mechanistic Modeling of Gas-Liquid Two-Phase Flow in Pipes. Ovadia Shoham: 2006: 408 pp.; Softcover: ISBN: 978-1-55563-107-9: Society of Petroleum Engineers
2. Organic Deposits in Oil and Gas production, Wayne Frenier, Murtuza Ziauddin, Ramachandran Venkatesan, 2010, Softcover: ISBN: 978-1-55563-291-5, Society of Petroleum Engineers
3. Formation, Removal, and Inhibition of Inorganic Scale in the Oilfield Environment,, Wayne Frenier, Murtuza Ziauddin, 2008, Softcover: ISBN: 978-1-61399-279-1, Society of Petroleum Engineers

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs.**

PART A: Part A/Question: <Short Notes, Problems, Numericals> **20 Marks**

PART B:<Justification, Criticism, Long answers, Interpretation > **80 Marks**

22TP422					MAJOR PROJECT		
Teaching Scheme					Examination Scheme		
L	T	P	C	Hours/Week	Report Writing	V/V	Total Marks
-	-	24	12	24	-	-	-

COURSE OBJECTIVES

- Develop skills to identify Research Gap.
- To develop your capacity to compute, analyse and interpret basic descriptive and inferential statistics
- Develop Team working skills and communication skills
- Improve writing skills in terms of technical report

COURSE CONTENT

Aim: To address specific industry and research related problems.

Unit 1: Experimentation and data analysis and Synthesis

Unit 2: Outcome, discussion and conclusion

Unit 3: Report Writing, Presentation and Viva-Voce

COURSE OUTCOMES

On completion of the course, student will be able to

CO1- Demonstrate the capability to generate relevant information from literature survey

CO2- Acquire research skills to identify the research problem and Knowledge Gap

CO3- Formulate the Research methodology and design experiments for primary data generation

CO4- Acquaint with the modern research analysis tools, software and instruments.

CO5- Capable of working as individual and team player for designing the research project

CO6- Develop communication skills, both written and oral.

REFERENCE BOOKS AND SOFTWARE

1. Kothari, C. P. (2008) Research Methodology: Methods and techniques,
2. Murray, R (2002) How to write a thesis, McGraw Hill Publication
3. Recent ENDNOTE Software for referencing
4. JABREF for Referencing.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs.**

PART A: Evaluation Based on the class performance and Laboratory book/report/thesis **50 Marks**

PART B: Viva Examination based conducted experiments **50 Marks**