17BPE201 - Mathematics III										
Teaching Scheme					Exam 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

UNIT I **Hours: 9**

Introduction of Some Special Functions: Gamma function, Beta function, Bessel function, Error function and complementary Error function, Heaviside's function, pulse unit height and duration function, Sinusoidal Pulse function, Rectangle function, Gate function, Dirac's Delta function, Signum function, Saw tooth wave function, Triangular wave function, Half wave rectified sinusoidal function, Full rectified sine wave, Square wave function.

Ordinary Differential Equations and Applications: **First order differential equations**: Basic concepts, Geometric meaning of y' = f(x,y) Direction fields, Exact differential equations, Integrating factor, Linear differential Equations and non linear Differential Equation (Bernoulli equations,) .

UNIT II **Hours: 10**

Linear differential equations of second and higher order: Homogeneous linear differential equations of second order, Modeling: Free Oscillations, Euler- Cauchy Equations, Wronskian, Non homogeneous equations, Solution by undetermined coefficients, Solution by variation of parameters, Higher order linear differential equations, Higher order homogeneous with constant coefficient, Higher order non homogeneous equations.

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 III **Hours: 10**

Fourier Series and Fourier Integral: Periodic function, Trigonometric series, Fourier series, Functions of any period, Even and odd functions, Half-range Expansion, Fourier integral.

Application of Partial Differential Equations: Separation of variables use of Fourier series, D'Alembert's solution of the wave equation, Heat equation: Solution by Fourier series and Fourier integral

UNIT IV **Hours: 10**

Power Series: Series Solution of Differential Equations: Power series method, Theory of power series methods, Frobenius method.

Laplace Transforms and Applications: Definition of the Laplace transform, Inverse Laplace transform, Linearity, Shifting theorem, Transforms of derivatives and integrals Differential equations, Unit step function Second shifting theorem, Dirac's delta function, Differentiation and integration of transforms, Convolution and integral equations, Partial fraction differential equations, Systems of differential equations

Total Hours: 39

Textbook:

1. Higher Engineering Mathematics, by B. S Grewal, Khanna Publication, Delhi

Reference Books:

1. Higher Engineering Mathematics Vol. 1 by Dr. K.R.Kachot, Mahajan Publishing House
2. Higher Engineering Mathematics Vol. 2 by Dr. K.R.Kachot, Mahajan Publishing House
3. Advanced Engineering Mathematics (8th Edition), by E. Kreyszig, Wiley-India (2007).
4. Engineering Mathematics Vol 2, by Baburam, Pearson
5. Elementary Differential Equations (8th Edition), by W. E. Boyce and R. DiPrima, John Wiley (2005)
6. Fourier series and boundary value problems (7th Edition), by R. V. Churchill and J. W. Brown, McGraw-Hill (2006).
7. T.M.Apostol, Calculus , Volume-2 (2nd Edition), Wiley Eastern , 1980
8. Engineering Mathematics, by Kreyszig E,Wiley Eastern Ltd.

17BPE202 - Applied Physics										
Teaching Scheme					Exam 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

Unit I **Hours: 7**

NANOPHYSICS: 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 II **Hours:7**

Classical Mechanics: 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 III **Hours:6**

Quantum Mechanics: 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 IV **Hours:6**

ADVANCED ENGINEERING MATERIALS:

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 (H_2O_2, Lithium cell), Ultra capacitors.

Total Hours: 26

Texts 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).

References books:

1. Kittel C., Knight W.O. and Ruderman M.A., Mechanics - Berkeley Physics Course, Vol. 1, Tata McGrawHill.
2. Purcell E.M. Electricity and Magnetism - Berkeley Physics Course, Vol.2, TataMcGraw-Hill.
3. Crawford F.S. - Waves and Oscillations, Berkeley Physics Course, Vol. 3,McGraw-Hill.
4. Feyman R.P., Leighton R.B. and Sands M. The Feyman Lectures on Physics, Vol. 1., Narosa Publication
5. Feyman R.P., Leighton R.B. and Sands M. The Feyman Lectures on Physics, Vol. 2. Narosa Publication
6. Griffith D.J.H., Introduction to Electrodynamics - Prentice Hall, India.
7. M. N. Avadhanulu, A text book of engineering Physics, S. Chand & Company, Ltd.
8. Brij Lal, N. Subrahmanyam, Heat and Thermodynamics, S. Chand & Company, Ltd.

17BPE203 - Thermodynamics										
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

Unit –I **Hours – 09**

Thermodynamic Potentials

Internal energy, enthalpy, Helmholtz free energy, Gibbs free energy; Thermodynamic property relations, Maxwell relations, Partial derivatives and Jacobian method; Residual properties; Partial molar properties, Ideal and non-ideal solutions, Standard states definition and choice, Gibbs-Duhem equation, Excess properties of mixtures.

Unit –II **Hours – 10**

Phase Equilibria

Criteria for equilibrium between phases in multi component non-reacting systems in terms of chemical potential and fugacity; Application of phase rule, vapour-liquid equilibrium, phase diagrams for homogeneous systems and for systems with a miscibility gap; Effect of temperature and pressure on azeotrope composition, liquid-liquid equilibrium, ternary liquid, liquid equilibrium; Activity coefficient-composition models, thermodynamic consistency of phase equilibria, application of the correlation and prediction of phase equilibria in systems of engineering interest particularly to distillation and liquid extraction processes.

Unit – III **Hours – 10**

Hydrocarbon reservoir fluids and their phase behavior

Hydrocarbon (Petroleum) Reservoir Fuid composition and their physical Properties; Thermodynamic behavior of naturally occurring hydrocarbon (Oil, gas, condensate) system.

Unit – IV **Hours - 10**

PVT Analysis of Hydrocarbon fluids

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.

Total Hours - 39

Texts and References: Recommended Books

1. Introduction to Chemical Engineering Thermodynamics – Smith, J.M., Van Ness, H.C., & Abbot M. C, McGraw Hill VII Edition 2004.
2. A Text Book of Chemical Engineering Thermodynamics Narayanan K. V – Prentice Hall of India Pvt. Ltd. 2001.
3. Petroleum Reservoir Rock and Fluid Properties – Abhijit Y. Dandekar- Taylor and Francis-2006.
4. Equations of State and PVT Analysis:Applications for improved Reservoir Modeling – Tarek

Ahmed, Gulf Publishing Company, Houstan Texas.
5. Fundamentals Principles of Reservoir Engineering – Brian F. Towler – SPE textbook series, Volume 8 – 2002.
6. Fundamentals of Reservoir Engineering – L. P. Dake – Elsevier, 17th Edition, 1998

17BPE204 - Heat and Mass Transfer										
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

Unit I **Hours: 10**

Heat Transfer

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 vapors

Unit II **Hours: 10**

Radiation

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 III **Hours: 10**

Mass Transfer

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 IV **Hours: 9**

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.

Total Hours: 39

Texts and References:

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.

17BPE205 - 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	
2	1	0	3	3	25	50	25	-	-	100

Unit - I **Hours – 7**

Basics of mechanics

Fundamental assumptions in elementary mechanics of materials (linearity, homogeneity, isotropy, elasticity, continuum); viscoelasticity or rheology; mechanical properties of metals – concepts of stress and strain; stress-strain behavior; anelasticity; 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, 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 . Mohr's circle; deviatoric and mean stress; special states of stresses by Mohr's circle; Mohr-Coulomb failure envelope.

Unit – II **Hours - 6**

Introduction to Materials Science and Engineering

Introduction to materials science and materials engineering; introduction to 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 ($Fe–Fe_3C$) 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 – III **Hours – 5**

Introduction to Rock Mechanics

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 – IV **Hours - 8**

Introduction to Reservoir Geomechanics

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 S_3 from mini-fracs and extended leak-off tests and constraining the magnitude of SH_{max} 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 Hours – 26

Texts and References:

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: Physical Principles and Applications; 5. Bansal R. K. A Textbook of Strength of Materials.

17BPE206 - 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

Unit I **Hours : 10**

Fundamentals of Petroleum Exploration

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 II **Hours : 10**

Geochemical Analysis

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 III **Hours : 10**

Fundamentals of Seismic processing, Interpretation and Attribute

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 IV : **Hours : 09**

G and M Methods

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 and SP logs, Shallow, Medium and Deep Resistivity logs, Porosity logs-Sonic, Neutron and Density logs, Importance of log interpretation, qualitative and quantitative Interpretation, Petrophysical evaluation, Correlation of well log with seismic, Preparation of synthetics, proposing drilling locations based on integrated studies.

Total Hours:- 39

Texts and References:

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.

17BPE207 - 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

Heat Transfer Practicals :

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 TransferPracticals :

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.

17BPE208 - 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

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)