Course Type	Course Code	NameofCourse	L	T	P	Credit
DC	NPEC509	**Numerical Methods for Petroleum Engineers**	3	1	0	4

CourseObjective

- Advancednumericaltechniquesforpetroleumengineeringapplications.
- Topreparestudentsforadvancedcoursesinreservoirmodellingandsimulation

LearningOutcomes

Upon Successful Completion Of This Course,students will:

- Abletonumerically Solve Linear Non-linear algebraic equations,ODEsandPDEs
- Applytheknowledgeforsolvingcomplexreservoirsimulationproblems.

Unit No.	Topicsto beCovered	Lecture Hours (L+T)	LearningOutcome
1.	Introduction-tools for numerical analysis(e.g.,Matlab,Excel,VBA),debugging and error handling;fundamental concepts of numerical methods–iteration, convergence, order, stability, Taylor's series, numerical errors and error propagation,and numerical dispersion.	4	Tolearnabouttheconceptand Applicability of numerical methods in petroleum engineering atdhe programming tools that can be used to carryout numerical analysis.
2.	Numerical differentiation and integration of functions;interpolation and smoothing;differentiation and integration discrete data series.linear and pseudo-linear least squares,introduction to regression and curve-fitting.	5+2	To Know About The Numerical Differentiation, integration of functions,regression analysis and curve-fitting
3.	LinearAlgebra:vectors,matrices,system of linear equations;directand iterative methods.	5+2	Toknowaboutthevectorsandtensors, andtheirapplicationsinpetroleumEngineeringproblems
4.	Nonlinear Algebraic Equations–roots of nonlinear equations, maxima and minima of nonlinear functions,local global extrema.Multivariable Methods:root findingandsearchfor extremas.Nonlinear Least Squares;regression analysis,polynomial curve-fitting.	5+2	Tofindtheprincipleoffindingtheroots Of Non-linear equations,localandglobalminimum/ maximumandbestfitted polynomial
5.	NumericalsolutionofODEsandapplications;numerical solution system inODEs.Numericalinversionof Laplace Transform Functions.	6+2	To Know The Principles Of Solving System of ODEs and numerical inversionofLaplacetransformations
6.	NumericalsolutionofellipticPDEs(e.g.,steady-state heat conduction equation)in2Dand3Dusingfinite difference.	6+2	Toknowtheprinciplesoffinitedifferenc etechniqueandsolvethe steady state heat conduction.
7.	Finite Element And Finite Volume methods.	5+2	ToknowtheprinciplesofFiniteelementandfinitevolumemethods
8	NumericalsolutionofparabolicPDEssuchas1Dtransientdiffusivityequation;numericalsolutionofsteady-state advective-diffusive equation (ADE) in 2Dand3D;numericalsolutionoftransientADEin2Dand 3D. Explicit and implicit solution, courant number and adaptive time stepping.	6+2	Tosolvelinearandnon-lineardiffusion equationsforreservoirsimulationnumerically.
	Totalcontact hours:	**42 +14 = 56**	

TextBooks:

1. NumericalMethodsforEngineers, S.C. Chapra and R.P. Canale, McGraw-Hill Education,7thEdition,,NewYork,NY,2015.

ReferenceBooks:

1. NumericalMethodsforEngineers, S.K. Gupta, ,NewAgeInternational Publishers, 3rd Edition,,NewDelhi, India,2015