	Course Academic Plan 2020-21	Course Code and Name: CSC 401 Engineering Mathematics -IV

The academic resources available in PHCET, Rasayani

PHCET AMS	Evaluation and Assessment	PHCET Library	Value added courses and MOOC courses
Institute & Department Vision and Mission	Former IA question papers and solutions (prepared by faculty)	Former IA question papers solutions - hardcopy	Value Added Courses (VAC) are conducted throughout the semester & in the semester break
Lesson Plan, Practical plan, Content delivery (Planned and Actual)	MU end semester examination question papers and solutions (prepared by faculty)	MU end semester exam question paper & solutions - by faculty, hardcopy	Online courses from NPTEL, Coursera etc. are pursued throughout the semester
Student attendance and performance	Class notes and Digital Content for the subject	All text books, reference books, e -books mentioned in the syllabus & AAP	Video recording of Lectures captured in Light board studio at PHCET is made available.
Student details	Comprehensive question bank, MCQ, PPT, Class Test papers	Technical journals and magazines for reference	Interactive smart board facility is available and lectures are recorded.
Departmental Academic plan	Academic Administration Plan & beyond Syllabus Activity report	PHCET library is member of IIT Bombay Library	Expert lectures by Industry/Academia

1. a Course Objectives (As per Blooms Taxonomy)

Sr. No	Course Objectives
	The course is aimed
CS 401.1	Matrix algebra to understand the engineering problems
CS 401.2	Line and Contour integrals and expansion of complex valued function in a power series.
CS 401.3	Z-Transforms and Inverse Z-Transforms with its properties.
CS 401.4	The concepts of probability distributions and sampling theory for small samples.
CS 401.5	Linear and Non-linear programming problems of optimization.

1.b Course Outcome (CO) Mapping with Modules

Sr. No.	COs	Related Module/s
	On successful completion of course student will be able to	
CO 1	Apply the concepts of eigen values and eigen vectors in engineering problems.	1
CO 2	Usethe concepts of Complex Integration for evaluating integrals, computing residues & evaluate various contour integrals	2
CO 3	Apply the concept of Z- transformation and its inverse in engineering problems.	3
CO 4	Use the concept of probability distribution and sampling theory to engineering problems.	4
CO 5	Apply the concept of Linear Programming Problems of optimization	5
CO 6	Solve Non-Linear Programming Problems to engineering problems of optimization.	6

1. c Mapping of COs with POs (mark 3: Strong, 2: Moderate, 1: Weak,0)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1	1	2	1	1	1	2	1	1	1	1	1
CO 2	1	1	1	2	1	2	1	1	2	2	1	2
CO 3	3	2	3	3	1	2	3	1	2	2	2	1
CO 4	1	1	1	2	3	1	1	3	1	1	1	1
CO 5	2	1	2	1	1	1	2	1	3	1	3	1
CO 6	1	1	2	2	3	1	1	1	3	1	1	1

1.d Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4
CO 1	1	1	2	1
CO 2	2	2	3	2
CO 3	2	3	2	2
CO 4	2	2	3	1
CO 5	3	3	2	1
CO 6	2	2	3	2

1.e Core Competency of the course

Categories	Mathematics	Basic Science & General Engineering.	Humanities & Soft Skill	Core Engg./ Technology - Design & Analysis	Multidisciplinary
Tick where applicable	√				

2.a Teaching Scheme (As specified by the University)

Teaching Scheme (Contact Hours)		Credits Assigned		
Theory	Pract.	Theory	Pract.	Total
3+1@	-	4	-	4

@ 1 hour to be taken as tutorial class wise

2.b Module Wise Teaching Hours and % Weightage in University Question Paper

Module No.	Module Title and Brief Details	Teaching Hrs. for each module	% Weightage in University Question Papers
1	Linear Algebra (Theory of Matrices)	06	25
2	Complex Integration	07	25
3	Z -Transforms	05	25
4	Probability Distributions and Sampling Theory	06	20
5	Linear Programming Problems	06	10
6	Non-Linear Programming Problems	06	15
Total		36	120

2.c Prerequisite Courses

Sr. No.	Semester	Name of the course	Topics covered
1	III	Engineering Mathematics I,II,III	Complex Variables,

2.d Relevance to Future Courses

Sr. No.	Semester	Name of the course

2.e Industry Application of the course

Sr. No	Application
1.	To apply the concept of eigen values and eigen vectors to solve engineering problems.
2.	To apply the concept of Probability distributions to the engineering problems.

3.	To apply the concept of complex integration to engineering problems.
4.	To apply the concept of Linear and Non-linear Programming problem in industry as well as engineering fields for drawing conclusion.

3.a Past Results –

	Division A & B			
AY Year	Initials of Teacher	% Result		
Dec 2019-20	AK	95%		

Topics which affect results negatively	Module Number	Recommendations to overcome these issues & improve result in future
Module 3	Fourier Series	To cover more as a part of this module

4.a Learning Resources – Books and E-Resources

4.b List of Text Books

Book Code	Title	Authors	Publication
B1	Higher Engineering Mathematics	Grewal B. S.	Khanna Publication 2005 38th edition
B2	Advanced Engineering Mathematics	Kreyszig E	9th edition, John Wiley.
B3	A Text Book of Applied Mathematics Vol. I & II	P. N. Wartikar and J.N. Wartikar	Vidyarthi Griha Prakashan, Pune

4.c List of Reference Books

Sr. No.	Reference book titles	Authors	Publisher	Edition	Module No
1	Advanced Engineering Mathematics	R. K. Jain and S. R. K. Iyengar,	Narosa	Revised	1, 2
2	Operations Research: An Introduction, ,	Hamdy A Taha	Pearson.	Revised	5 & 6
3	Complex Variables and Applications	Brown and Churchill	McGraw-Hill education	Revised	2
4	Probability, Statistics and Random Processes	T. Veerarajan	McGraw-Hill education	Revised	4
5	Engineering Optimization: Theory and Practice	S. S. Rao	Wiley-Blackwell.	Revised	5 & 6

4.d List of E – Books

Sr. No.	E book titles	Authors	Publisher	Edition	Module No

4.eWeb Links and Names of Magazines, Journals, E-journals

Sr. No.	Web-Links and Names of Journals and E-Journals Recommended	Web-Links and Names of Magazines Recommended	Module Nos.

5. Concept Inventory

Sr. No.	Chapter	**Concepts**	Text Book	Start Page	End Page	No. of Pages	App. Effort in Hrs	App. Marks
1	Linear Algebra (Theory of Matrices)	1.1 Introduction & basic concepts of eigen values of characteristic matrix	B1	1.02	1.08	6	1	18
		1.2 Properties of eigenvalues & eigenvectors	B1	1.16	1.22	7	1	
		1.3 Cayley –Hamilton theorem : Problems- Verification & evaluation.	B1	1.22	1.51	28	2	
		1.4 Similarity of matrices	B1	1.55	1.64	56	1	
		1.5 Diagonalisable matrices -Problems	B1	1.89	1.100	31	2	
2	Complex Integration	2.1 Line Integrals –Basic concepts and Problems	B1	1.101	1.105	5	2	21
		2.2 Cauchy's Integral theorem for simple connected and multiply connected regions and Cauchy's Integral formula –Problems based on them.	B1	2.02	2.44	44	2	
		2.3 Taylor's and Laurent's series - Problems	B1	3.01	3.39	40	1	
		2.4 Definition of Singularity, Zeroes, poles of *f(z)*, Residues, Cauchy's Residue Theorem & Problems.	B1	4.01	4.12	13	1	
3	Z - Transforms	3.1 Definition and Region of Convergence, Transform of Standard Functions: $\{k^n a^k\}, \{a^{\lvert k\rvert}\}, \{^{k+n}_{n}C.a^k\}, \{c^k \sin(\alpha k+\beta)\}, \{c^k \sinh \alpha k\}, \{c^k \cosh \alpha k\}$.	B1	4.16	4.41	25	2	21
		3.2 Properties of Z Transform: Change of Scale, Shifting Property - Problems	B1	4.43	4.63	21	2	
		3.3 Multiplication, and Division by k, Convolution theorem with Problems	B1	5.10	5.18	18	1	
		3.4 Inverse Z transform: Partial Fraction Method, Convolution Method : Problems	B1	5.19	5.42	24	2	
4	Probability Distributions and Sampling Theory	4.1 Probability Distribution: Poisson and Normal distribution : Problems	B1	6.01	6.52	51	4	21
		4.2. Sampling distribution, Test of Hypothesis, Level of Significance, Critical region, One-Two tailed test.	B1	7.01	8.60	91	3	

		4.3 Students' t-distribution (Small sample). Test the significance of mean and Difference between the means of two samples. Chi-Square Test: Test of goodness of fit and independence of attributes, Contingency table	B1	9.01	9.12	12	3	
5	Linear Programming Problems	5.1 Types of solutions, Standard and Canonical of LPP, Basic and Feasible solutions, slack variables, surplus variables, Simplex method.	B1	10.20	10.41	22	3	21
		5.2 Artificial variables, Big-M method (Method of penalty) : Problems ; Duality, Dual of LPP and Dual Simplex Method.	B1	11.02	11.30	26	3	
6.	Non-Linear Programming Problems	6.1 NLPP with one equality constraint (two or three variables) using the method of Lagrange's multipliers 6.2 NLPP with two equality constraints 6.3 NLPP with inequality constraint: Kuhn-Tucker conditions	B1					18
Author: Dr. Avinash J. Kamble			Total Effort in Hours				36	120

6.0 Web Links for Online Notes/YouTube/ Digital Content/Lecture Capture/NPTEL Videos

Sr. No	Websites/ Links	Module No
1		
2		

7. Recommended MOOC Courses like Coursera / NPTEL / Swayam/ edX etc.

Sr. No.	MOOC course link	Resource Person	Course duration	Certificate (Y/N)
1			3 Months	Y
2			3 Months	Y

8. Study Material Distributed among Students

GA	Notes (Hand Written)	Digital content	PPT	MCQ	Other
	√			Yes	

9. Lesson Plan

Lecture No	Module No.	Topics planned	Mapping with CO	Planned Date	Actual Date
		Linear Algebra (Theory of Matrices)			
1		Introduction : Eigen values of a matrix	1		
2		Properties of Eigenvalues	1		
3	**01**	Eigen vectors _Problems based on them	1		
4		Cayley-Hamilton Theorem	1		
5		Similarity of matrices	1		
6		Diagonalizable and non-diagonalizable matrices.	1		
		Complex Integration			
7		Basic concept : Line Integral	2		
8		Cauchy's Integral Theorem	2		
9	**02**	Cauchy's Integral Formula	2		
10		Taylor's & Laurent's series	2		
11		Singularity, Zeroes, poles of *f(z)* and residues	2		
12		Cauchy's Residue Theorem	2		
		Z - Transforms			
13		Basic concept, Definition and Region of Convergence.	3		
14		Transforms of some standard functions	3		
15	**03**	Property: Change of scale & Shifting property	3		
16		Property: Multiplication & Division	3		
17		Convolution theorem & Inverse transforms	3		
18		Partial fraction method & convolution method	3		
		Prob. Distribution & Sampling theory			
19		Poisson Distribution	4		
20	**04**	Normal Distribution	4		
21		Sampling Theory : Basic concepts	4		
22		Testing of hypothesis , t -distributions	4		
23		Small samples : Problems	4		
24		Chi-Square test	4		
		Linear Programming Problem			
25	**05**	Types of solutions, Standard and Canonical of LPP	5		
26		Basic and Feasible solutions, slack variables, surplus variables, Simplex method	5		
27		Problems : Simplex Method	5		
28		Artificial variables, Big-M method	5		
29		Problems : Big –M method	5		
30		Duality, Dual of LPP and Dual Simplex Method	5		

	06	**Non-Linear Programming Problem**			
31		NLPP with one equality constraint with two variables using the method of Lagrange's multipliers	6		
32		NLPP with one equality constraint with three variables using the method of Lagrange's multipliers.	6		
33		NLPP with two equality constraints	6		
34		Problems :Two equality constraints	6		
35		NLPP with inequality constraint: Kuhn-Tucker conditions	6		
36		Problems: Kuhn-Tucker conditions	6		

10. Rubric for Grading and Marking of Term Work

Lecture + Practical (% Attendance) & Marks	Assignments	Tutorial	Lab / Practical Performance	Lab Journal Assessment	Mooc Course	Total
NA	Mini Project	Batch wise tutorials	NA	NA	NA	

11. Assignment Plan

Assignment No.	Module no.	assignment	Mapping with Cos
1	1	Problems to find eigenvalues & eigenvectors of a matrix	1
2	2	Problems to find line integrals, evaluation of residues.	2
3	3	Problems on Z-transforms based on properties	3
4	4	Problems on Prob. distributions and t-distributions.	4
5	5	Problems on LPP by simplex & Big M method	5
6	6	Problems on NLPP by Kuhn-Tuker conditions.	6

12. Beyond Syllabus Activities for Gap Mitigation

No	Type of the Activity	Activities	Details – no of attendees, guest, feedback, mark sheet, report
1.	Awareness about applications of Mathematics	Mathematical modelling	
2.			

Academic Plan prepared by

Name of Faculty: **Dr. Avinash J. Kamble**

Domain Co-ordinator SIG Coordinator HOD