Dr. Ambedkar Institute of Technology, Bengaluru-56
(An Autonomous Institute, Affiliated to VTU, Belagavi)

Master of Computer Applications Program
(Accredited by National Board of Accreditation)

INTERDEPARTMENT ELECTIVES
(2020 – 2022)

Dr. Ambedkar Institute of Technology

(An Autonomous Institute affiliated to VTU, Accredited by NAAC with 'A' grade)

Department of Master of Computer Applications

SCHEME OF TEACHING AND EXAMINATION OF MCA INTERDEPARTMENT
ELECTIVE (AUTONOMOUS) 2020-2022

Sl. No.	Course Code	Course Title	Teaching hours per week			Examination				Credits	Eligibility
			Lecture	Tutorial	Practical / Seminar	Duration in hours	SEE Marks	CIE Marks	Total Marks		
1	20MCAE01	Data Science using Python	3	-	-	3	50	50	100	3	All Branches
2.	20MCAE02	Professional Practices for Higher Education	3	-	-	3	50	50	100	3	All Branches
3.	20MCAE03	R programming for statistics and data Science	3			3	50	50	100	3	All Branches
4.	20MCAE04	Full stack web development	3			3	50	50	100	3	All Branches
5.	20MCAE05	Animation and Gaming	3			3	50	50	100	3	All Branches
6.	20MCAE06	Ethical Hacking	3			3	50	50	100	3	All Branches
		Total	6	-	-	6	100	100	200	06	

DATA SCIENCE USING PYTHON

Sub Code:		20MCAE01	CIE Marks:	50
Number of Lecture Hours per week:		3	SEE Marks:	50
Total number of Lecture Hours:		39	SEE Hours:	3
Lecture (L): 3	Practical (P): 0	Tutorial (T): 0	Total Credits:	3

COURSE LEARNING OBJECTIVES (CLO)

- **Describe the Fundamentals of Python**

- **Demonstrate the python data structure**

- **Implement the data wrangling and data preprocessing**

- **Understand and learn data analytics concept using Numpy, pandas and data visualization.**

MODULES	TEACHING HOURS
MODULE 1: Python Collections	**6 Hrs**
Strings: Creating and storing strings, string operations, formatting Strings. Lists: Basic List operations, Built in functions used on lists, List Comprehensions. Tuples and Sets: Basic Operations on Tuples, Functions to Process Tuples. Set Methods, set operations. Dictionaries: Operations on Dictionaries, Dictionary Methods.	
MODULE 2: Numpy, Pandas and Data Visualization	**9 Hrs**
Numpy: The Numpy Array, N-dimensional array operations and manipulations. Data processing using arrays. **Pandas:** Essential Functionality, Data frames, computing descriptive statistics, Time series analysis with pandas. **Data Visualization:** Matplotlibs package-plotting graphs-controlling Graph- Adding Text- More Graph types. Data Visualization with Seaborne.	
MODULE 3: Introduction to Data Science, Data Pre-processing and Data Wrangling	**8 Hrs**
Introduction to Data Science: Introduction to Data science, Applications of Data Science, Roles, components, Life cycle of data science. Acquiring Data with python: Loading from different files, Accessing databases.	

Data Wrangling: Missing values, duplicate, grouping, merging, combining concatenating, Reshaping(pivoting),Data Transformation –Mapping.	
MODULE 4: Statistical measures	**7 Hrs**
Understanding Descriptive statistics, standard deviations, probability distribution, Normal distribution-Skewness, kurtosis, Inferential statistics-Hypothesis testing- t-test -One Sampled t-test, Correlation -Person correlation coefficient, Linear Algebra	
MODULE 5: Modelling techniques	**9 Hrs**
Classification techniques-Naïve Bayes classifier, K Nearest Neighbor Classification Technique. Implementation in Python Clustering techniques, Applications, k-means Clustering algorithm, Performance of k-means, choosing Initial centroid- Implementation in Python, Efficiency using Confusion matrix	

Question Paper Pattern:
- **Each full question consists of 20 marks.**
- **Questions are set covering all the topics under each module**

Text Books:

1. Python for Data Analysis 2nd Edition, O'Reilly Publications

2. Python Data Analytics Fabio Nelli , Apress

3. Data Science from Scratch, Joel Grus, O'Reilly Publications

Reference Books

1. Python Data Science Handbook, Essential Tools for Working with Data, Jake VanderPlas, O'Reilly Publications

2. Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining, Addison-Wesley, 2005

COURSE OUTCOMES (CO)

CO1:Understand the Fundamentals of Python programming

CO2: Demonstrate various features of python programming for building   applications.

CO3: Apply python programming for designing the applications efficiently.

CO4:Design and Develop applications to be deployed in real world scenarios.

COURSE OUTCOMES MAPPING WITH PROGRAM OUTCOMES

Course Outcomes(CO)	Mapping with Program Outcomes(PO)
CO 1	**PO1,PO2,PO3,PO4,PO5,PO8**
CO 2	**PO1,PO2,PO3,PO4**
CO 3	**PO1,PO2,PO3,PO4,PO5**
CO 4	**PO1,PO2,PO3,PO4,PO5**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
LEVEL OF CO-PO MAPPING TABLE												
CO1	M	H	H	M	H							
CO2	H	M	H	H	L							
CO3	M	M	H	H	L					M	M	
CO4	M	M	H	H	L					H	H	

PROFESSIONAL PRACTICES FOR HIGHER EDUCATION				
Course Code:		**20MCAE02**	**CIE Marks:**	**50**
Number of Lecture Hours per week:		**3**	**SEE Marks:**	**50**
Total number of Lecture Hours:		**39**	**SEE Hours:**	**3**
Lecture (L): 3	**Practicals (P):** 0	**Tutorial (T):** 0	**Total Credits**	**3**

COURSE LEARNING OBJECTIVES (CLO)

- **Learn to accurately use the vocabulary of English in writing**
- **Learn to speak fluently with appropriate link words**
- **Acquire knowledge on enhancing the reading capability**
- **Understand the techniques for improving the listening skills**

MODULES	TEACHING HOURS
MODULE 1: Fundamentals of Higher Education and Reading skills	**8 Hrs**
GRE, IELTS – An Overview, Mode of Preparation. Examination Process. Reading: Working on improving the Reading capability, Speaking: Advice on how to improve performance - What the examiner is looking for? Insight into how examiners assess candidate performance in the speaking test. Advice and tips on how to deal effectively with subjects about which you have insufficient knowledge Writing: Improve performance in the writing test What the examiner is looking for? Assessing candidate performance in the writing test Listening: Improve performance in the learning test What the examiner is looking for? Assessing candidate performance in the learning test Question types: • Classification • Yes, No, Not given Topic: Art and culture Question types: • Multiple selection • Summary completion • Table completion • Matching headings to paragraphs • Sentence completion.	
MODULE 2: Working on Reading Skills	**8 Hrs**
Diagram completion • Classification • Short answer questions -Sentence completion • Summary completion Table completion • Diagram completion • Short answer questions • Sentence completion	
MODULE 3: Working on Writing Skills	**8 Hrs**
Practice exercises for reports on static charts - Practice exercises for reports on dynamic charts Practice exercises for compositions discussing arguments for and against -Practice exercises for reports on tables Practice exercises for compositions giving an opinion Practice exercises for reports on diagrams showing objects Practice exercises for compositions discussing the causes of a problem and suggesting solutions - Practice exercises for reports on static	

charts- Practice exercises for compositions discussing advantages and disadvantages- Practice exercises for reports on dynamic charts and graphs- Practice exercises for compositions discussing arguments for and against - Practice exercises for reports on tables	
MODULE 4: Working on Listening Skills	**8 Hrs**
Form completion • Classification Summary completion • Table completion • Short answer questions • Labelling a diagram • Form completion • • Sentence completion	
MODULE 5: Working on Speaking Skills	**7 Hrs**
Tutorial: Interview Phase - An analysis of the individual long turn phase of an IELTS speaking test, with commentary on the candidate's performance and score Interview Phase An analysis of the two-way discussion phase of an IELTS speaking test, with commentary on the candidate's performance and score	
Question Paper Pattern: • **Each full question consists of 20 marks.** • **Questions are set covering all the topics under each module**	
Text Books	
1. Cambridge IELTS Trainer, Louise Hashemi and Barbara Thomas, Cambridge Publications	
Reference Books	
1. Online IELTS Practice Materials	
COURSE OUTCOMES (CO)	
CO1: Demonstrate enhanced knowledge on reading capability	
CO2: Demonstrate to use the vocabulary of English in writing	
CO3: Apply the techniques to improve the listening efficiency	
CO4: Apply the skills to speak fluently with appropriate link words	

COURSE OUTCOMES MAPPING WITH PROGRAM OUTCOMES:

Course Outcomes(CO)	Mapping with Program Outcomes(PO)
CO 1	PO9
CO 2	PO9
CO 3	PO9
CO 4	PO9

LEVEL OF CO-PO MAPPING TABLE

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1									H			
CO2									H			
CO3									H			
CO4									H			

R PROGRAMMING FOR STATISTICS AND DATA SCIENCE

Sub Code:			20MCAE03		CIE Marks:	50
Number of Lecture Hours per week:			3		**SEE Marks:**	50
Total number of Lecture Hours:			39		**SEE Hours:**	03
Lecture (L):	3	**Practicals (P):**	0	**Tutorial (T):** 0	**Total Credits:**	3

COURSE LEARNING OBJECTIVES (CLO)

- **To understand the concepts of Data science.**

- **To analyse the sampling techniques for data classification.**

- **To implement modelling methods for machine learning problems.**

- **Analyzing data from files and visualizing graphical presentations using R.**

MODULES	TEACHING HOURS
MODULE 1: Data Science	**7 Hrs**
Introduction, Evolution of data science, Data science process – roles, stages in data science project – components of the Data Science lifecycle, data analytics, exploring data – managing data – cleaning and sampling for modeling and validation	
MODULE 2: Exploratory Data Analysis using R	**8 Hrs**
Introduction, R features basic data types, Vectors, Lists, Arithmetic, logical & Matrix Operations, Control structures, Functions in R, Data frames, Reading Data & cleaning data, Data visualization techniques –Histograms, box plot, bar chart, scatter plot.	
MODULE 3: Statistical Analysis	**8 Hrs**
Descriptive statistics, Inferential Statistics-Hypothesis testing- t-test -One Sampled and two sampled tests, Correlation -Person correlation coefficient. Probability Distributions, Normal Distribution- Binomial Distribution- Poisson Distributions	
MODULE 4: Data Science algorithms	**8 Hrs**
Classification of Regression Analysis, Regression process, Linear Regression, Understanding Linear regression, making prediction-hypothesis on regression	

coefficients, multiple Linear Regression, concepts and formulas, Logistic regression, Model building and making predictions, Adding best fit.	
MODULE 5: Analytical Algorithms	**8 Hrs**
Classification techniques-Decision Trees, K Nearest Neighbor Classification Technique. Implementation in R Clustering techniques, Applications, k-means Clustering algorithm, Performance of k-means, choosing Initial centroid- Implementation in R, Efficiency using Confusion matrix	

Question Paper Pattern:

- **Each full question consists of 20 marks.**

- **Questions are set covering all the topics under each module**

Textbooks:

1. Nina Zumel, John Mount, "Practical Data Science with R", Manning Publications, 2014.

2. Mark Gardener, Beginning R- The Statistical Programming Language, John Wiley & Sons, Inc, 2012.

3. Joseph Schmuller, "Statistical Analysis with R", John Wiley, 2017.

Reference Books

1. David Dietrich, Barry Heller," Data Science & Big Data Analytics: Discovering, Analysing, Visualizing and Presenting Data", Wiley,2015

2. Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining, Addison-Wesley, 2005

COURSE OUTCOMES (CO)

CO1: Explain role of data science and the significance of exploratory data analysis (EDA) in data science.

CO2: Apply statistics and computational analysis for data to make predictions using analytical tools.

CO3: Apply basic machine learning algorithms for predictive modelling and interpret the results visually.

CO4: Construct use cases to validate approach and identify modifications required.

COURSE OUTCOMES MAPPING WITH PROGRAM OUTCOMES:

Course Outcomes (COs)	Mapping with Program Outcomes (POs)
CO1	PO1, PO2
CO2	PO1, PO2, PO4, PO5

CO3	PO1, PO2, PO4, PO5, PO7
CO4	PO4, PO5, PO7

LEVEL OF CO-PO MAPPING TABLE

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	H										
CO2	L	M		H	M							
CO3		M		H	H		H					
CO4				M	H		H					

FULL STACK WEB DEVELOPMENT			
Sub Code:	**20MCAE04**	**CIE Marks:**	**50**
Number of Lecture Hours per week:	**3**	**SEE Marks:**	**50**
Total number of Lecture Hours:	**39**	**SEE Hours:**	**3**
Lecture (L): 3 Practicals (P):	**Tutorial (T): 0**	**Total Credits:**	**3**

COURSE LEARNING OBJECTIVES (CLO)

- **To design as web page using front end technologies**

- **To develop application with server side scripting tools**
- **To develop web application with REST APIs and use of framework to communicate client-server applications.**
- **To build as responsive web application with managing NOSQL databases.**

MODULES	TEACHING HOURS
MODULE 1: Introduction to React	**8 Hrs**
Welcome to React: Obstacles and Roadblocks, React's future, keeping up with the changes, working with the files. The Basics-Introduction, Installation, getting started -hello world program, Lifecycle of Components,	
MODULE 2: React Components and Redux	**8 Hrs**
React Props, React state-setting state, Event handling, Designing components-state vs props	
MODULE 3: Programming in Node.js	**8 Hrs**
Node.js Installation –getting started, Control flow, asynchronous pattern callback, Sequential functionality, nested callbacks and exception handling, asynchronous patterns and control flow. Routing Traffic, Serving Files and Middleware: Building a Simple Static File Server from Scratch, Middleware, Routers and Proxies	
MODULE 4: Exposing REST APIs	**8 Hrs**
REST-HTTP Methods as actions, Express-Routing, Handler Functions, The List API-automatic Server Restart, testing, Create API, Error Handling.	
MODULE 5: MongoDB	**7 Hrs**
Introduction to MongoDB: -Installation-Databases, Data Types, Using MongoDB Shell. Creating, Updating, Deleting and Querying Documents: Inserting, removing, and updating the documents. Scheme Initialization, Reading and writing to Mongodb.	
Question Paper Pattern: • **Each full question consists of 20 marks.** • **Questions are set covering all the topics under each module**	
Text Books:	

1. Tomasz Dyl Kamil Przeorski, "Mastering Full-Stack React Web Development", 2017 Packt Publishing.

2. Vasan Subramanian ,"ProMERN Stack",Apress,2018.

Reference Books

1. Eddy Wilson Iriarte Koroliova ,"MERN-Full stack Development", Packt Publishing Ltd.,2018

2. Shama Hoque,"Full stack React Projects",Pack Publishing Ltd.,2018.

COURSE OUTCOMES (CO)

CO1: Demonstrate basic concepts of react, node, express and mongodb techologies

CO2: Design front end application using React libraries.

CO3: Develop interactive web applications on server side with NOSQL databases.

CO4: Build responsive web application communicating with REST API and managing data with NOSQL databases.

COURSE OUTCOMES MAPPING WITH PROGRAM OUTCOMES:

Course Outcomes(Cos)	Mapping with Program Outcomes(POs)
CO1	PO5, PO11
CO2	PO2, PO4, PO5, PO11
CO3	PO2, PO4, PO5, PO7, PO11
CO4	PO5, PO11

LEVEL OF CO-PO MAPPING TABLE

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					H						M	
CO2		M		H	H						L	
CO3		L		M	H		H				H	
CO4					M						H	

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ANIMATION AND GAMING

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Course Code:		20MCAE05		CIE Marks:	50
Number of Lecture Hours per week:		3		SEE Marks:	50
Total number of Lecture Hours:		39		SEE Hours:	3
Lecture (L):	3	Practicals (P): 0	Tutorial (T): 0	Total Credits	3

COURSE LEARNING OBJECTIVES (CLO)

- **Understand the design histories and theories to develop creative, technical and analytical skills in animation film and Game production.**
- **Enable to manage Animation Projects from its Conceptual Stage to the final Product creation.**
- **Expertise in life-drawing and related techniques.**
- **Explore different approaches in computer animation**

MODULES	TEACHING HOURS
MODULE 1:Fundamentals of Animation	**8 Hrs**
History of Animation, Introduction to Animation, Terms used in Animation ,Types of Animation, Skills for Animation Artist, Basic Principles of Animation, Animator's Drawing Tools, Rapid Sketching & Drawing , Developing Animation Character , equipment required for animation Developing the characters with computer animation, 2 D virtual drawing for animation, sequential movement drawing, Thumbnails, motion studies , drawing for motion.	
MODULE 2:Introducing 3D Animations	**8 Hrs**
Introduction to Maya application, Maya History and future, System Requirements, Autodesk Maya Graphical User Interface, Class Fundamentals, UI Elements,Poly engineering: Product Design, Architectural Design, references for Modeling,Industrail Design Reference Setup, Industrial Design Reference Match in Maya, Industrial Design Basic Model.	
MODULE 3: L & F and Aesthetics Development	**8 Hrs**
Fundamental of Texturing,Shades:Maya Shades and Photorealistic Shades, Shades Types; Background Shades and Layered Shades, Working in Photorealistic shades. Refining the Lighting, Rendering, Indirect and Direct Lighting Technique.UVW Map 2D Projection:Genreating UV Maps,UV Editors, Animation walk Cycle Project.	
MODULE 4:FX and Dynamic Simulation	**8 Hrs**
Rigid Body Dynamic, Particles Simulation, Fluid Simulation, Fundamentals of Hair and fur, Maya integration with ARNOLD.	
MODULE 5: Visual Effects and Case Study	**7 Hrs**

Creating Optif/X, Particle Effects, Nurbs Spaceship, Animating the Ships, Animating a Walk Cycle,3D Movie and Games.

Question Paper Pattern:

- **Each full question consists of 20 marks.**
- **Questions are set covering all the topics under each module**

Text books

1. The Complete Animation course by Chris Patmore, By – Barons Educational Series (New York)

2. Learning Maya Version 1.0, Alias|Wavefront, a division of Silicon Graphics Limited. January 1998 .

Reference Books

1. 3Ds Max- Bible 2011 By – Kelly L. Murdock WILEY PUBLICATIONS

COURSE OUTCOMES (CO):

CO1: Understand the laws of human motion and psychology in 2-D or 3-D Characters.

CO2: Apply the animation across a variety of platforms including film, television, advertising, web, motion capture and game design.

CO3: Analyse different approaches in computer animation.

CO4: Design different Animation projects from its Conceptual Stage to the final Product creation.

COURSE OUTCOMES MAPPING WITH PROGRAM OUTCOMES:

Course Outcomes(CO)	Mapping with Program Outcomes(PO)
CO1	PO1, PO5, PO3, PO4, PO5
CO2	PO1, PO2, PO10, P1O2
CO3	PO4, PO5
CO4	PO10, PO11, PO12

LEVEL OF CO-PO MAPPING TABLE

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	H	M	M	H							
CO2	H	M								M		H
CO3				M	H							
CO4										M	H	H

ETHICAL HACKING				
Sub Code:		**20MCAE06**	**CIE Marks:**	**50**

Number of Lecture Hours per week:		3		SEE Marks:	50
Total number of Lecture Hours:		39		SEE Hours:	3
Lecture (L):	3	Practicals (P):	0	Tutorial (T):	1	Total Credits:	3

COURSE LEARNING OBJECTIVES (CLO)

- **Students will remember and understand the fundamental aspects and importance of ethical hacking**
- **Students will gain knowledge on the basic working principles of Kali Linux environment**
- **Students will apply the hacking tools to identify the security issues and exploitable insecurities**
- **Students will analyse and assess the effectiveness of the security policies.**

MODULES	TEACHING HOURS
MODULE 1: Introduction	**08 Hrs**
Concept of Ethical Hacking: Hacking, Hackers, Types of Hackers - Phases of hacking: Reconnaissance, Scanning, Gaining Access, Maintaining access, Clearing tracks, Reporting Ethical Hacking - Working of an ethical hacker, responsibilities Vulnerabilities: Human and System - Exploits: Gaining access and denying access Gaining access: Social engineering, Passive password acquisition, Phishing, Spear-phishing, and Whaling Web Exploits: SQL Injection, URL Manipulation, Cross-Site Scripting and Request Malicious activity: Denial-of-Service attacks, malware, viruses, worms Defensive Security: Protecting self, password and email practices, computer software security, network security and encryption, web application security	
MODULE 2: Getting started with Kali Linux and Getting anonymous	**08 Hrs**
Installing VMWare, Kali Linux – Overview Command line arguments: ls, cd, mkdir, rmdir, cp, rm, mv, updatedb, grep, echo, man Networking Commands: ifconfig, iwconfig, ping, arp, netstat, route Users and Privileges: chmod, useradd, userdel, passwd Anonymity: Working with Proxychains: installation, tor service, proxychains.conf Address Spoofing: What is Address Spoofing, MAC address spoofing – Spoofing with Macchanger	
MODULE 3: Information Gathering and Scanning	**08 Hrs**
Reconnaissance: What is Reconnaissance? Types – HTTrack: Features - Working with HTTrack and WebHTTrack	

Information gathering: What is information gathering? - Types – Maltego: Features - Working with Maltego Recon-ng: What is Recon-ng and Features – uses – Working with Recon-ng recon-ng Passive information gathering tool: Dmitry: Features and usages – Working with Dmitry Scanning: Definition, Phases of scanning: Determining live systems, using ping and ping sweeps – Port scanning: Working with Nmap-using Nmap for TCP connect scan, SYN scan, Xmas scan, Null scan – Vulnerability Scan: Definition, Working with Nessus tool Wireless network analysis: Features of wireless network analysis – wireless network detection with kismet	
MODULE 4: Exploitation	**08 Hrs**
Exploits: What is Exploits? Types: Active and Passive Gaining access to remote services: Working with Medusa Network sniffing: What is network sniffing – Types – network sniffing with wireshark Metasploit: Working with Metasploit framework - Modules: Exploit, payloads, auxillary, post-exploitation, NOP generator - working with MSFconsole - MSFconsole commands – Payloads in Metasploit - Using the database in Metasploit Password cracking: Definition – Working with John the ripper tool	
MODULE 5: Web-based Exploitation and Maintaining Access	**07 Hrs**
Web application analysis: Spidering a website - burpsuite: Features – Tools: spider, proxy, intruder, repeater, sequencer, decoder, extender, scanner– spidering with burpsuite Wireless attacks: Features of aircrack-ng – monitoring, attacking, testing, cracking– working with aircrack-ng Maintaining Access: Definition – Tools: backdoor, covert channel, root kit, data exfiltration – working with sbd tool	
Question Paper Pattern: • **Each full question consists of 20 marks.** • **Questions are set covering all the topics under each module**	
TextBooks:	
1. Basics of hacking and penetration testing, Patrick Engebretson, Elsevier, 2011 edition	
2. Computer Hacking Beginner's Guide. Alan T. Norman	
Reference Books	
1. Hacking: The Art of Exploitation, John Ericson, 2nd Edition	
2. Penetration Testing: A Hands-On Introduction to Hacking by Georgia Weidman	
3. Hacking for Beginnners: Manthan Desai -2010-	

COURSE OUTCOMES (CO)
CO1: Remember the fundamental aspects of hacking and understand the role of ethical hacking
CO2: Develop a practical understanding on the basic principles and techniques of Kali Linux
CO3: Apply various hacking tools to gather information and gain access to networks and systems
CO4: To build a network system with an offensive security strategies

Course Outcomes mapping with Program Outcomes

Course Outcomes(CO)	Mapping with Program Outcomes(PO)
CO1	PO3, PO6, PO10
CO2	PO4, PO5
CO3	PO3, PO4, PO5, PO6, PO10
CO4	PO4, PO5, PO10

LEVEL OF CO-PO MAPPING TABLE

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			M			L				M		
CO2				L	H							
CO3			M	H	H	L				M		
CO4				H	H					M		