BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI
WORK INTEGRATED LEARNING PROGRAMMES
HANDOUT-FLIPPED

Part A: Course Design

Course Title	**Data Visualization**
Course No(s)	**BA ZC420 / SE ZC420**
Credit Units	**4**
Credit Model	
Content Authors	SWARNA CHOUDHARY

Course Objectives

No	Description
CO1	The course aims at understanding the concept of good data visualization
CO2	Best Practices of Dashboard Design
CO3	Data Visualization using Tableau
CO4	Data Visualization using Python (Bokeh/Matplotlib/Seaborn)

Text Book(s)

T1	Storytelling with Data, A data visualization guide for business professionals, by Cole Nussbaumer Knaflic; Wiley
T2	Information Dashboard Design: Displaying data for at-a-glance monitoring, Stephen Few, second edition

Reference Book(s) & other resources

R1	Hands on Data Visualization with Bokeh: Interactive web plotting for Python using Bokeh, by Kevin Jolly

Learning Outcomes:

No	Learning Outcomes
LO1	Concepts and best practices of Data Visualization
LO2	Best practices of Information Dashboard Design
LO3	Data Visualization using Tableau
LO4	Data Visualization using Python (Bokeh/Matplotlib/Seaborn)

BITS Pilani
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Part B: Content Development Plan

Academic Term	Second Semester 2020-2021
Course Title	Data Visualization
Course No	**BA ZC420 / SE ZC420**
Content Developer	SWARNA CHOUDHARY

Glossary of Terms

Module	**M**	Module is a standalone quantum of designed content. A typical course is delivered using a string of modules. M2 means module 2.
Contact Hour	**CH**	Contact Hour (CH) stands for an hour long live session with students conducted either in a physical classroom or enabled through technology. In this model of instruction, instructor led sessions will be for 32 CH.
Recorded Lecture	**RL**	RL stands for Recorded Lecture or Recorded Lesson. It is presented to the student through an online portal. A given RL unfolds as a sequences of video segments interleaved with exercises.
Lab Exercises	**LE**	Lab exercises associated with various modules
Self-Study	**SS**	Specific content assigned for self study
Homework	**HW**	Specific problems/design/lab exercises assigned as homework

Modular Structure

Module Summary

No.	Title of the Module
M1	Introducing Data Visualizations
M2	Designing Visuals
M3	Building Dashboards
M4	Exploring Data Visualization Tools
M5	Visual Analytics with Tableau
M6	Plotting Visuals with Python

Detailed Structure

M1: Introducing Data Visualizations

Type	Description/Plan/Reference
DV_RL_1.1.1	Why Data Visualizations?
DV_RL_1.1.2	Explanatory Analysis

DV_RL_1.1.3	Understanding Context	
DV_RL_1.1.4	Storytelling Ideas	
DV_RL_1.1.5	Tables & related visuals	
DV_RL_1.1.6	Axis based Visualization	
DV_RL_1.1.7	Visuals to be Avoided	
CS 1.1	• Need for visualizations in data analysis • Understanding Context with example	T1 Ch 1
CS 1.2	• Discussion of Storytelling Concepts • Guidelines for selection of visuals	T1 Ch1,2
SS 1	• Why Do We Visualize Quantitative Data? • Data Visualization – How to Pick the Right Chart Type? • 5 Things You Should Know Before You Make a Pie Chart	

M2: Designing Visuals

Type	**Description/Plan/Reference**	
Effective Visuals Design-I		
DV_RL_2.1.1	Cognitive Load	
DV_RL_2.1.2	Clutter	
DV_RL_2.1.3	Gestalts' Principle of Visual Medium	
DV_RL_2.1.4	Other types of Clutter	
DV_RL_2.1.5	Decluttering Exercise I	
DV_RL_2.1.6	Decluttering Exercise II	
CS 2.1	• Cognitive Load and Clutter • Visual Ordering	T1 Ch3
CS 2.2	• Use of Contrast • Guidelines for decluttering of visuals	T1 Ch3
SS 2	• Designing great visualizations • Visual Perception	
Effective Visuals Design-II		
DV_RL_2.2.1	Types of Memory	

DV_RL_2.2.2	Pre-attentive Attributes in Texts/Tables	
DV_RL_2.2.3	Pre-attentive Attributes in Graphs	
DV_RL_2.2.4	Strategic Use of Color in Visuals	
DV_RL_2.2.5	Visual Makeover Case Study	
DV_RL_2.2.6	Design Concepts I	
DV_RL_2.2.7	Design Concepts II	
CS 3.1	• Grabbing Audience Attention • Examples of pre-attentive attribute usage	T1 Ch4
CS 3.2	• Examples of usage of traditional design concept in visuals design	T1 Ch5
SS 3	• The Data Visualization Design Process: A Step-by-Step Guide for Beginners	

M3: Building Dashboards

Type	**Description/Plan/Reference**	
Dashboard		
DV_RL_3.1.1	Dashboards	
DV_RL_3.1.2	Types of Dashboards	
DV_RL_3.1.3	Characteristic of Dashboard	
DV_RL_3.1.4	Dashboard Data	
CS 4.1	• Discussion about Performance Dashboards	T2 Ch1,2
CS 4.2	• Example dashboards from different domains like sales, finance etc.	T2 Ch8
SS 4	• A Guide to Creating Dashboards People love to use, Translating Delicious Data into a Beautiful Design	
Dashboard Design		
DV_RL_3.2.1	Mistakes in Dashboard Design I	
DV_RL_3.2.2	Mistakes in Dashboard Design II	
DV_RL_3.2.3	Visual Design Process - I	

DV_RL_3.2.4	Visual Design Process - II	
DV_RL_3.2.5	Visual Design Process - III	
DV_RL_3.2.6	Visual Design Process - IV	
DV_RL_3.2.7	Visualization / Dashboards Tools Overview	
CS 5.1	• More examples about dashboard design mistakes • Illustration of Visual Design Process	T2 Ch3 T2 Ch5
CS 5.2	• Dashboard for Usability • Dashboard / Visualization tools Orientation	T2 Ch7
SS 5	• Pervasive Hurdles to Effective Dashboard Design • Dashboard Design for at-a-glance monitoring • 3 Key Criteria When Selecting Data Visualization Tools • 20 free and open source data visualization tools	

M4: Exploring Data Visualization Tools

Type	**Description/Plan/Reference**	
DV_RL_4.1.1	Google Data Studio (GDS)	
DV_RL_4.1.2	GDS - Connect	
DV_RL_4.1.3	GDS - Visualize I	
DV_RL_4.1.4	GDS - Visualize II	
DV_RL_4.1.5	GDS - Share	
DV_RL_4.1.6	Microsoft PowerBI	
DV_RL_4.1.7	PowerBI Data Connections	
DV_RL_4.1.8	PowerBI Dashboard Design	
DV_RL_4.1.9	PowerBI Dashboard Shairing	
CS 6.1	• Exploration Data using Google Data Studio features	GDS Docs
CS 6.2	• Analysis of Data using Microsoft Power BI desktop version	PowerBI Docs

SS 6	• 10 Best Practices for Building Effective Dashboards • A Beginner's guide and tutorial for Google Data Studio • Microsoft PowerBI Getting Started Tutorial

M5: Visual Analytics with Tableau

Type	Description/Plan/Reference	
Analyzing Data with Tableau-I		
DV_RL_5.1.1	Need for Visual Analysis	
DV_RL_5.1.2	Tableau Ecosystem	
DV_RL_5.1.3	Tableau Desktop Getting Started	
DV_RL_5.1.4	Tableau Data Connections	
DV_RL_5.1.5	Tableau Metadata Management	
DV_RL_5.1.6	Tableau Data Extracts	
DV_RL_5.1.7	Tableau Data Prep	
DV_RL_5.1.8	Tableau Joins	
DV_RL_5.1.9	Tableau Data Blending	
DV_RL_5.1.10	Tableau Visual Analysis	
DV_RL_5.1.11	Tableau Visual Interface	
DV_RL_5.1.12	Tableau Drill Downs and Hierarchies	
DV_RL_5.1.13	Tableau Sorting	
DV_RL_5.1.14	Tableau Grouping	
CS 7.1	• Discussion Visual Analysis for Everyone • Data Preparation with Tableau Desktop features	Tableau Learning
CS 7.2	• Exploring Cards , Shelves on Visual Interface • Data Exploration with Tableau Features	Tableau Learning
SS 7	• Visual Analysis Best Practices: A Guidebook • Tableau for Students • Best practices for tidy data using Tableau	
Analyzing data with Tableau-II		

DV_RL_5.2.1	Tableau Filtering	
DV_RL_5.2.2	Tableau Parameters	
DV_RL_5.2.3	Tableau Calculations I	
DV_RL_5.2.4	Tableau Calculations II	
DV_RL_5.2.5	Tableau Calculations III	
DV_RL_5.2.6	Tableau Dashboard I	
DV_RL_5.2.7	Tableau Dashboard II	
DV_RL_5.2.8	Tableau Dashboard III	
DV_RL_5.2.9	Tableau Stories	
CS 8.1	• Exploring Filtering, Groups, Hierarchies in detail • Exploring Tableau Built-in Functions	Tableau Learning
CS 8.2	• Story-boarding data story • Putting Compelling Data Visualizations into Persuasive Business Presentations	Tableau Learning
SS 8	• Get Started with Tableau Desktop • Best Practices for Telling Great Stories	

M6: Plotting Visuals with Python

Type	Description/Plan/Reference	
Plotting Visuals with MatplotLib		
DV_RL_6.1.1	Matplotlib Installattion	
DV_RL_6.1.2	MatplotLib First Visual	
DV_RL_6.1.3	Parts of Visual	
DV_RL_6.1.4	Life Cycle of a Plot	
DV_RL_6.1.5	MatlplotLib PyPlot	
DV_RL_6.1.6	MatplotLib Plotting Other Visuals	
CS 9.1	• Data Visualization samples with MatplotLib	Matplotlib Docs
CS 9.2	• Geospatial and Three D visualization with MatplotLib	Matplotlib Docs

SS 9	• Samples MatplotLib charts • Pyplot tutorial	
Plotting Visuals with Seaborn and Bokeh		
DV_RL_6.2.1	Seaborn Vs MatplotLib	
DV_RL_6.2.2	Seaborn Plotting Statistical Relationships	
DV_RL_6.2.3	Seaborn Visualizing Continuity with Lines	
DV_RL_6.2.4	Seaborn Plotting Categorical Data	
DV_RL_6.2.5	Seaborn Plotting Univariate Distribution	
DV_RL_6.2.6	Seaborn Plotting BiVariate Distributions	
DV_RL_6.2.7	Seaborn Plotting Linear Regression Models	
DV_RL_6.2.8	Bokeh introduction	
DV_RL_6.2.9	Bokeh Building Blocks	
DV_RL_6.2.10	Bokeh Glyphs	
DV_RL_6.2.11	Bokeh Simple Plots	
DV_RL_6.2.12	Bokeh Plotting with Different Data Structures	
DV_RL_6.2.13	Bokeh Decorating the Visuals	
DV_RL_6.2.14	Bokeh Interactive Server Side Applications I	
DV_RL_6.2.15	Bokeh Interactive Server Side Applications II	
DV_RL_6.2.16	Bokeh Interactive Server Side Applications III	
CS 10.1	• Data Visualization samples with Seaborn • Viewing statistical relationship with Seaborn visuals	Seaborn Docs
CS 10.2	• Data Visualization samples with Bokeh • Building server side application using Bokeh	R1
SS 10	• Seaborn Tutorial for Beginners • Interactive Data Visualization in Python With Bokeh	

CS	CH	Pre-CH	During CH	Post-CH
1	1	DV_RL_1.1.1- 1.1.4	CS 1.1	
	2	DV_RL_1.1.5-1.1.7	CS1.2	SS 1
2	3	DV_RL_2.1.1-2.1.3	CS 2.1	
	4	DV_RL_2.1.4-2.1.6	CS 2. 2	SS 2
3	5	DV_RL_2.2.1-2.2.5	CS 3.1	
	6	DV_RL_2.2.6-2.2.7	CS 3.2	SS 3
4	7	DV_RL_3.1.1-3.1.2	CS 4.1	
	8	DV_RL_3.1.3-3.1.4	CS 4.2	SS 4
5	9	DV_RL_3.2.1-3.2.2	CS 5.1	
	10	DV_RL_3.2.3-3.2.7	CS 5.2	SS 5
Mid Semester Exam				
6	11	DV_RL_4.1.1-4.1.5	CS 6.1	
	12	DV_RL_4.1.6-4.1.9	CS 6.2	SS 6
7	13	DV_RL_5.1.1-5.1.9	CS 7.1	
	14	DV_RL_5.1.10-5.1.14	CS 7.2	SS 7
8	15	DV_RL_5.2.1-5.2.5	CS 8.1	
	16	DV_RL_5.2.6-5.2.9	CS 8.2	SS 8
9	17	DV_RL_6.1.1-6.1.3	CS 9.1	
	18	DV_RL_6.1.4-6.1.6	CS 9.2	SS 9
10	19	DV_RL_6.2.1-6.2.7	CS 10.1	
	20	DV_RL_6.2.8-6.2.16	CS 10.2	SS 10
End Semester Exam				

Experiential Leaning Component

Activity	Topic	Description
1	Getting started with Tableau	● Setup of Tableau Desktop for Analytics ○ Tableau License for BITS students ○ Obtaining and installing Tableau desktop

2	Visual Analysis with Tableau	● Basic visualizations and operations using Tableau ○ Familiarity with Data prep ○ Basic plotting ○ Operations on visualizations
3	Advanced Visual Analysis with Tableau	● Visualizations supporting advanced operations ○ Analytics ○ Maps ○ Calculated fields
4	Dashboards and Storytelling with Tableau	● Preparing dashboards for storytelling ○ Dashboards ○ Stories ○ Formulate a story using the visuals and dashboards
5	Getting started with Python	● Python Setup ○ Usage of Python and Anaconda Navigator platform with Jupyter notebooks
6	Plotting visuals with Python Matplotlib	● Matplotlib library for Data visualization ○ Usage of Python and Matplotlib library available for data plotting

Evaluation Scheme:
Legend: EC = Evaluation Component; AN = After Noon Session; FN = ForeNoon Session

No	Name	Type	Duration	Weigh t	Day, Date, Session, Time
EC-1	Experiential Learning Assignment-I	Online Take home	-	10%	TBA
	Experiential Learning Assignment-II		-	15%	TBA
EC-2	Mid-Semester Test	Open Book	2 hours	30%	Sunday, 07/03/2021 (FN) 10 AM - 12 Noon
EC-3	Comprehensive Exam	Open Book	2 hours	45%	Sunday, 02/05/2021 (FN) 10 AM - 12 Noon

Exam Syllabus:
Syllabus for Mid-Semester Test (Closed Book): Topics in Module 1 to 3
Syllabus for Comprehensive Exam (Open Book): All topics Module 1 to 6

Important links and information:
Elearn portal: https://elearn.bits-pilani.ac.in

Students are expected to visit the Elearn portal on a regular basis and stay up to date with the latest announcements and deadlines.

Contact sessions: Students should attend the online lectures as per the schedule provided on the Elearn portal.

Evaluation Guidelines:

1. EC1 consists of two assignments. Announcements will be made on the portal, in a timely manner.
2. For Closed Book tests: No books or reference material of any kind will be permitted.
3. For Open Book exams: Use of books and any printed / written reference material (filed or bound) is permitted. However, loose sheets of paper will not be allowed. Use of calculators is permitted in all exams. Laptops/Mobiles of any kind are not allowed. Exchange of any material is not allowed.
4. If a student is unable to appear for the Regular Test/Exam due to genuine exigencies, the student should follow the procedure to apply for the Make-Up Test/Exam which will be made available on the Elearn portal. The Make-Up Test/Exam will be conducted only at selected exam centres on the dates to be announced later.

It shall be the responsibility of the individual student to be regular in maintaining the self study schedule as given in the course handout, attend the online lectures, and take all the prescribed evaluation components such as Assignment/Quiz, Mid-Semester Test and Comprehensive Exam according to the evaluation scheme provided in the handout.