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

COURSE HANDOUT

Part A: Content Design

Course Title	**Data Visualization and Interpretation**
Course No(s)	
Credit Units	5
Course Author	Febin.A.Vahab
Version No	
Date	

Course Description

The course provides an insight on the best practices used in Data Visualization and also illustrates the best tools used to achieve the same

Course Objectives

No	Description
CO1	To introduce key techniques and theory used in visualization, including data models, graphical perception and techniques for visual encoding and interaction.
CO2	Solving various visualization problem using tools like Tableau, Python (Matplotlib)
CO3	Best Practices of Dashboard Design, Designing dashboards meeting the design principles for various requirements

Text Book(s)	
T1	Storytelling with Data, A data visualization guide for business professionals, by Cole Nussbaumer Knaflic; Wiley
T2	Data Visualisation : A Successful Design Process By Andy Kirk
T3	Visualize This: The Flowing Data Guide to Design, Visualization & Statistics, by Nathan Yau, Wiley
T4	Information Dashboard Design: Displaying data for at-a-glance monitoring, Stephen Few, second edition
T5	Tableau Your Data: Fast and Easy Visual Analysis with Tableau Software, by Daniel G Murray
T6	Matplotlib for Python Developers: Effective techniques for data visualization with Python, by Aldrin Yim, Claire Chung and Allen Yu
T7	Hands on Data Visualization with Bokeh: Interactive web plotting for Python using Bokeh, by Kevin Jolly
R1	Mastering Tableau, by David Baldwin

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 (Matplotlib)

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Part B: Content Development Plan

Academic Term	Second Semester 2018 - 19
Course Title	**Data Visualization**
Course No	
Credit	5
Content Developer	

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 Session	**CS**	Contact Session (CS) stands for a 2 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 16 CS.
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	Data Visualizations and Practices
M2	Effective Dashboard Design
M3	Data Visualization with Tableau
M4	Data Visualization with Python – 1 (Matplotlib)
M5	Data Visualization with Python – 2 (Bokeh, Seaborn)

Detailed Structure

M1: Data Visualizations and Practices
Contact Session 1-3

Type	Description/Plan	Reference Text Book/Chapters

CS1	• Introduction
	• Exploiting the Digital age
	• Visualisation as a Discovery tool
	• Visualisation skills for the masses
	• The Visualisation methodology
	• Visualisation design objectives
	• Exploratory vs. explanatory analysis
	• Understanding the context for data presentations
	• 3 minute story
	• Effective Visuals
	  o Textuals
	  o Tabulars
	  o Graphicals
		T1
		Ch 1 and 2,T2 Ch1

	• Gestalt principles of visual perception • Visual Ordering • Decluttering	T1 Ch 3

CS2	• Preattentive attributes in text and graphs
	  o Size
	  o Color
	  o Position
	• Data Design concepts
	  o Affordances
	  o Accessibility
	  o Aesthetics
		T1 Ch 4
		
		T1 Ch 5

	• Storytelling • Visualization Design Lessons	T1 Ch 7 T1 Ch 8
CS3	**Taxonomy of Data Visualisation Methods** • Comparing Categories of Plots • Dot Plot • Bar Chart • Floating Bar • Histogram • Radial Chart • Glyph Chart	T2 Ch 5

	• Case Studies
	  o Visualizing Pattern Over time
	  o Visualizing Proportions
	  o Visualizing Relationships
		T3 , Ch 4, 5, 6

SELF STUDY		

- Data-Driven Documents (D3.js charts)
  - Exploring visual gallery
  - Simple charts creation
- https://d3js.org/
- Explore more D3 charts examples
- Explore Google charts library
- https://developers.google.com/chart/
- Good Enough to Great: A Quick Guide for Better Data Visualizations
- https://www.tableau.com/learn/whitepapers/good-enough-great-quick-guide-better-data-visualizations

M2: Data Visualization with Tableau
Contact Session 4-7

Type	Description/Plan	Reference
CS4	• Exploring Tableau o User Interface o Tableau Prep o Data Connection o Data Preparation	T5 Ch 1, 2, 3 https://www.tableau.com/learn/training
CS5	• Visual Analytics o Data Analysis o Visuals	https://www.tableau.com/learn/training T5 Ch 3, 4
CS6	• Maps	T3 Ch 6
	• Dashboard and Stories	https://www.tableau.com/learn/training T5 Ch 8
CS7	• Beyond the Basic Chart Types o Bullet graphs o Pareto charts o Custom background images	R1 Ch 7
	• Visualization Best Practices and Dashboard Design	R1 Ch 10
SELF STUDY		
• Explore the different types of visuals that can be plotted with Tableau interface		

M3: Effective Dashboard Design
Contact Session 8-10

Type	Description/Plan	Reference
CS8	• Dashboard • Dashboard categorization and typical data • Characteristics of a Well-Designed Dashboard • Key Goals in the Visual Design Process	T4 Ch 2 and 5

	• Common Mistakes in Dashboard Design	T4 Ch 3
CS9	• Power of Visual Perception o Visually Encoding Data for Rapid Perception o Applying the Principles of Visual Perception to Dashboard Design	T4 Ch 4
	• Effective Dashboard Display Media • Dashboards design for Usability	T4 Ch 6 T4 Ch 7
CS10	• Case Studies o Sample Sales Dashboard o Sample CIO Dashboard o Sample Telesales Dashboard o Sample Marketing Analysis Dashboard	T4 Ch 8
	• Bringing it all together with Dashboards o How Dashboard Facilitates Analysis and Understanding o How Tableau Improves the Dashboard-building process o The right way to build a Dashboard o Best Practices for Dashboard building	T5 Ch8
SELF STUDY		
• Explore any 2 dashboard design tools https://dzone.com/articles/20-free-and-open-source-data-visualization-tools • Build Your Competitive Edge: 12 Powerful Retail Dashboards https://www.tableau.com/learn/whitepapers/powerful-retail-dashboards • 10 Best Practices for Building Effective Dashboards https://www.tableau.com/learn/whitepapers/10-best-practices-building-effective-dashboards		

M4: Data Visualization with Python – 1 (Matplotlib)
Contact Session 11-14

Type	Description/Plan	Reference
CS11	• Merits of Matplotlib • The Lifecycle of a Plot • Pyplot • Matplotlib visuals basics	https://matplotlib.org/tutorials/index.html T6 Ch 1 and Ch2
CS12	• Plot styles types • Visual Decorations	http://www.labri.fr/perso/nrougier/teaching/matplotlib/ T6 Ch 3
CS13	• Advanced Matplotlib	T6 Ch4
CS14	**Matplotlib in the real word** • Plotting data from a database • Plotting data from a CSV file	T6 Ch9

	• Plotting extrapolated data using curve fitting • Plotting geographical data	
SELF STUDY		
• Analysis of time series data using matplotlib • Plotting Univariate Distributions • Plotting Bivariate Distributions		

M5: Data Visualization with Python – 2 (Seaborn and Bokeh)
Contact Session 15-16

Type	Description/Plan	Reference
CS15	• Seaborn package o Seaborn vs Matplotlib o Data Loading o Seaborn Basic Plots	https://seaborn.pydata.org/ https://www.datacamp.com/community/tutorials/seaborn-python-tutorial
	• Statistical plots with Seaborn	https://www.datacamp.com/courses/introduction-to-data-visualization-with-python
CS16	• Plotting using Glyphs • Plotting with different Data Structures	T7 Ch 1 T7 Ch 2
	• Using Annotations, Widgets, and Visual Attributes for Visual Enhancement • Building and Hosting Applications Using the Bokeh Server	T7 Ch 4 T7 Ch 5
SELF STUDY		
• Try out all the statistical plots mentioned in datacamp's tutorial • https://www.datacamp.com/courses/introduction-to-data-visualization-with-python • Try out the Bokeh tutorial • https://www.analyticsvidhya.com/blog/2015/08/interactive-data-visualization-library-python-bokeh/		

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

No	Name	Type	Duration	Weight	Day, Date, Session, Time
EC-1	Assignment-I	Online	-	15%	
EC-1	Assignment-II	Online	-	15%	
EC-2	Mid-Semester Test	Closed Book	2 hours	30%	
EC-3	Comprehensive Exam	Open Book	3 hours	40%	

Note: Assignment can be replaced by QUIZ also.
Syllabus for Mid-Semester Test (Closed Book): Topics in Session Nos. 1 to 8
Syllabus for Comprehensive Exam (Open Book): All topics (Session Nos. 1 to 16)

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.

LAB MODULES HAVE TO BE DEVELOPED