

GUJARAT TECHNOLOGICAL UNIVERSITY

BRIDGE COURSE MATHEMATICS

B.E. 1st YEAR (w.e.f July 2014)

CONTENTS:

Sr. No.	Subject Content
1.	Standard Graphs and their properties
2.	Understanding of derivative
3.	Applications of derivative
4.	Concepts of Maxima and Minima
5.	Curves defined by Parametric equations
6.	Concepts of Integration
7.	Find the area of shaded region
8.	Application of differential equations – real world problems
9.	Solution of simultaneous linear equations by matrix

Course Planning :-

Session 1: Pumping out of the tank

Lesson focus: Understanding concept of derivative.

Aim of activity: student will become familiar with the concept of derivative.

Personal aim: To develop construction skill through mathematical modeling.

Assumptions: Students know the basic formulas like area of circle, surface area and volume of cylinder
also know how to make a tank.

Anticipated problems and solutions:

Problems: How to put a tap in a tank, from which material tank should be prepare.

Solutions: We can put a hole and straw can work as tap. We can use plastic bottle as a tank.

Session 2: Measurement of velocity of motion of a spring when mass is suspended at its end.

Lesson focus: Understanding concept of derivative and its applications and student will able to apply
derivative in engineering field.

Aim of activity: Student will able to find out rate of change of one variable with respect to change in
other variable and will be able to apply the concept in field of engineering.

Personal aim: To develop observation ability and make analysis.

Assumptions: Student should know about tangent and how to find out slope of a curve.

Anticipated problems and solutions:

Problems: Where to hang spring.

Solutions: It can be hang in window or a student can stand holding it.

Session 3: To construct a cuboid (open from top) having maximum volume from a given sheet of paper.

Lesson focus: Development of the skill of applying derivative.

Aim of activity: Student will become familiar with concept of maxima and minima.

Personal aim: To develop think out of box ability.

Assumptions: Student should know formula of volume.

Anticipated problems and solutions:

Problems: How to make cuboid from the sheet of paper.

Solutions: Open the cuboid- reverse engineering.

Session 4: Measurements of area of real territories.

Lesson focus: Student will be able to understand the concept of integration.

Aim of activity: To be familiar with concept of measurement and integration.

Personal aim: To be familiar with surveying and field work.

Assumptions: Student should know the basic formula related to measurement.

Anticipated problems and solutions:

Problems: No any liable problem.

Solutions:-----

Session 5: Construction and measurement of 2D & 3D figures.

Lesson focus: To be able to construct different mathematical models.

Aim of activity: Student will be able to measure the area and volume of models by using integration.

Personal aim: Able to prepare model from waste to best.

Assumptions: students having knowledge of different mathematical shape.

Anticipated problems and solutions:

Problems: Measurement of 3D mathematical shape.

Solutions: Visualization by overlapping of figures.

Session 6: Solving Electrical circuits through matrices.

Lesson focus: To be able to correlate electric circuits and mathematics.

Aim of activity: Student will be able to find current and voltage with help of matrix theory.

Personal aim: To be able to make circuit from available equipments.

Assumptions: Student should know Kirchoff law of current and voltage.

Anticipated problems and solutions:

Problems: Lack of knowledge about making a circuit.

Solutions: proper guidance.

Session 7: Decoding of message through cryptography.

Lesson focus: To correlate linear algebra and computer science.

Aim of activity: Student will be familiar with cryptography by using linear algebra.

Personal aim: To know the importance of ethical hacking.

Assumptions: Knowledge of matrices and operation of it.

Anticipated problems and solutions:

Problems: Method of coding or decoding message.

Solutions: Proper hint.

Session 8: Graph shifting property and visualization through SciLAB

Lesson focus: Introduction to graphs, curves and SciLAB.

Aim of activity: Student will be able to visualize graphs and curves of various functions.

Personal aim: To develop imagination skill.

Assumptions: Knowledge about basic curves.

Anticipated problems and solutions:

Problems: No liable problem.

Session 9: Presentation and quiz on Bridge course activities

Lesson focus: Overall idea of bridge course

Aim of activity: Student will be able to conclude all the activities.

Personal aim: Development of presentation skill, observation skill, anchoring skill, leadership quality.

Assumptions: active participation in all the activities.

Anticipated problems and solutions:

Problems: Stage fear.

Solutions: Student will learn from others presentation and motivation.

Evaluation of Bridge course

1. How student preparing model or participating in activity.
2. Accuracy of prepared model.
3. Ability to correlate activity to mathematics.
4. Logical or creativity skill.
5. Team work ability.
6. Presentation skill.
7. Skill of thinking to going beyond topic
8. Leadership skill for management and execution of activity.
9. Anchoring skill for quiz

Rubrics for the evaluation :

Sr. No.	Evaluation Criterion	Marks
01.	for each activity from Activity 1 to 8	5
02.	for activity 9	10
	Total	50

Learning Resources :-

Course Material :-

- Presentations, Video and Course planning are provided.

Books:-

- 1.

Useful sites:-

Suggested Activities:

Sr. No.	Particular	Interaction between whom	Time	Aim	Procedure
1	Pumping out of the tank	Faculty-student	5 min	student will become familiar with the concept of derivative	Faculty will give idea about the activity and ask to prepare tank having a tap in the bottom and which empties in exactly 5 min.
		student-student	30 min		Groups of students will prepare tank according to

					guidance.
		student-student	15 min		Student will open the tap and will take readings of time duration which is require to empty the tank.
		Faculty-student	5 min		Faculty will ask students to give feedback and also to discuss strategies that they had applied and allow them to do brain storming for the execution of the activity.
		student-student	15 min		Students will give feedback about their experiences.
		student-student	10 min		On the base of feedback students will do brain storming to execute activity.
		student-student	15 min		After healthy discussion, they will again try to complete it.
		student-student	5 min		From above exercise students would be able to know use of derivative in this activity.
		Faculty-student	15 min		Faculty will concretely explain about the concept of derivative and explain them how derivative is useful in this activity.
		student-student	5 min		Conclusion from students.
	Total time of Activity 1:		120 min		
2	Measurement of velocity of motion of a spring when mass is suspended at its end.	Faculty-student	5 min	Student will able to find out rate of change of one variable with respect to change in other variable and will be able to apply the concept in field of engineering.	Faculty will instruct student about the experiment.
		student-student	20 min		Student will hang the 20gm mass at the end of spring and will take readings of oscillations up to 5min at the interval of 30 sec. For each reading they will find out velocity of the spring.
		student-student	15 min		On the basis of the readings student will draw graph of number of oscillations vs time.
		Faculty-student	10 min		Now faculty will ask students to relate the velocity which is obtained from the experiment to the graph.
		student-student	15 min		Students will have group discussion that how to relate velocity with graph.
		student-student	20 min		Student would be able to know the relation between rate of change of oscillations and slope of the graph at respective time.

		Faculty-student	20 min		Faculty will briefly explain role of derivative and velocity in this activity.
		student-student	15 min		Students will share their ideas about activity 1 & 2 and they will try to give more relevant examples.
	Total time of activity 2:		120 min		
3	To construct a cuboid (open from top) having maximum volume from a given sheet of paper.	Faculty-student	10 min	Student will become familiar with concept of maxima and minima.	Faculty will guide students to prepare a cubical container such that it may carry maximum volume from the given sheet of fixed measures.
		student-student	10 min		Student will discuss about activity and give suggestion to execute it.
		student-student	30 min		Student will apply their thought process to construct the cuboid and also they will measure the volume of the cuboid.
		student-student	20 min		Students will do assessment of their and other's models and they will search out that which model is having maximum capacity.
		student-student	25 min		Students will do case study on all the models and will derive conclusion of the case study.
		Faculty-student	10 min		Faculty will explain the concept of maxima and minima and correlate it with derivative.
		student-student	15 min		On the base of suggestions from faculty, students will remodel in required form.
	Total time of activity 3:		120 min		
4	Measurements of area of real territories.	student-student	5 min	To be familiar with concept of measurement and integration.	Faculty will ask students to form groups.
		Faculty-student	5 min		Now faculty will instruct what they have to perform group wise in this activity.
		student-student	60 min		Student will measure area of regions of the campus assigned by faculty.
		Faculty-student	5 min		Faculty will ask the students to give the problems that they have faced during measurement of regions.
		student-student	20 min		Students will share their experience and difficulties.
		Faculty-student	10 min		Faculty will explain relation of measurement of regions and integration and will ask best two groups to explain this activity in context of integration and measurement.

		student-student	5 min		Students will prepare themselves for explanation of this activity.
		student-student	10 min		Now best two group will explain about this activity.
	Total time of activity 4		120 min		
5	Construction and measurement of 2D & 3D figures.	6Faculty-student	5 min	Student will be able to measure the area and volume of models by using integration.	Faculty will ask students to draw known 2D & 3D mathematical shapes.
		student-student	10 min		Students will perform the task.
		Faculty-student	10 min		Faculty will ask students to prepare model of 2D & 3D mathematical shapes from card sheet.
		student-student	30 min		Student will try to cut, mold, fold and paste the card sheet to construct mathematical shape like frustum, trapezoidal, paraboloid, etc.
		Faculty-student	5 min		Faculty will ask student to measure capacity of model they have prepared.
		student-student	10 min		Student will have brain storming on how to measure capacity of model and reach that it is very difficult to measure.
		Faculty-student	5 min		Faculty will ask to solve it by help of calculus.
		student-student	5 min		Student will try to complete the task.
		Faculty-student	10 min		Faculty will explain concept of integration and relate it with measurement of model.
		Faculty-student	10 min		Faculty will give brief idea of SciLAB software and demonstrate some example of measurement of model. Faculty will give small assignment on this activity using SciLAB.
		student-student	20 min		Student will complete the assignment.
	Total time of Activity 5		120 min		
6	Solving Electrical circuits through matrices.	Faculty-student	5 min	Student will be able to find current and voltage with help of matrix theory.	Faculty will ask students to explain Kirchoff law of current (KCL) and voltage (KVL).
		student-student	10 min		Students will explain about KCL & KVL.
		Faculty-student	10 min		Faculty will ask students to prepare circuit from available wires, batteries, capacitors and resistors.
		student-student	20 min		Student will prepare circuit as per guidance and will measure current

					flow and voltage with help of voltmeter and A-meter.
		Faculty-student	5 min		Student will be asked to measure current flow and voltage without voltmeter and A-meter.
		student-student	30 min		Student will have brain storming session on it and try to execute the activity.
		Faculty-student	10 min		Faculty will explain mathematical modeling of electrical circuit and ask students that how to solve system of linear equation. Faculty will ask them to complete the activity.
		student-student	15min		Student will use system of linear equation to solve KCL & KVL.
		student-student	15 min		3 students will conclude the activity.
	Total time of activity 6:		120 min		
7	Decoding of message through cryptography.	Faculty-student	5 min	Student will be familiar with cryptography by using linear algebra.	Faculty will ask students to form 10 groups.
		student-student	5 min		Student will follow the instruction.
		Faculty-student	10 min		Faculty will ask five groups to choose a message and using some particular method convert it into safe code (password) and other five groups have to crack that code to get the original message.
		student-student	20 min		Five groups will convert chosen message to safe code.
		student-student	25 min		Other five groups will try to crack the code.
		Faculty-student	10 min		Faculty will ask five groups to convert message into safe code with the help of matrices and they have to provide the coding matrix to other five groups for cracking the code.
		student-student	15 min		Five groups convert message into safe code by using matrix and provide coding matrix to the other five groups.
		student-student	15 min		Other five groups will try to crack the code to get original message using provided coding matrix.
	Total time of activity 7		120 min		
8	Graph shifting property and	Faculty-student	10 min	Student will be able to visualize	Faculty will ask student to draw the

	visualization through SciLAB			graphs and curves of various functions.	$y = x$, $y = \sin x$, standard graph like $y = x $, $y = x^2$ etc. in graph book.
		student-student	30 min		Student will draw the graph in graph book.
		Faculty-student	10 min		Now faculty will modify the above $y = x - 1$, $y = \sin x + 1$, functions like $y = x + 1 $, and $y = x^2 - 3$ will ask them to draw their graphs.
		student-student	30 min		Student will draw the graph in graph book.
		Faculty-student	10 min		Faculty will ask students to compare the modified functions graphs with standard functions graphs and conclude this activity.
		student-student	20 min		Students will compare the graphs and try to reach at conclusion.
		student-student	10 min		Five students will give conclusion of the activity.
	Total time of activity 8		120 min		
9	Presentation and quiz on Bridge course activities		80 min	To develop presentation skill and active learning skill.	10 groups of student will give presentation for 8 min on learning outcomes from the activities and will try to relate mathematics and engineering.
		student-student			
		student-student	10 min		Preparation for Quiz
		student-student	30 min		Quiz on the base of all activities.
	Total time of activity 9:		120 min		