Thapar Institute of Engineering & Technology \ Patiala

Dr. Vishal Gupta

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THAPAR INSTITUTE
OF ENGINEERING & TECHNOLOGY
(Deemed to be University)

Overview of the course

Mechanical Engineering Department

Course coordinator
Dr. Vishal Gupta
Assistant Professor
Mechanical Engineering Department

Course Co-coordinator
Dr. Sachin Singh
Assistant Professor
Mechanical Engineering Department

Electronics and Communication Engineering Department

Course Coordinator
Dr. Poonam Verma
Assistant Professor
Electronics and Communication Engineering Department

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ENGINEERING DESIGN PROJECT-I
UTA016

Lecture - 1

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Old vs new methdology

Old Methodology

- Labs are out of Sync

- Outdated

- A defined set of rules

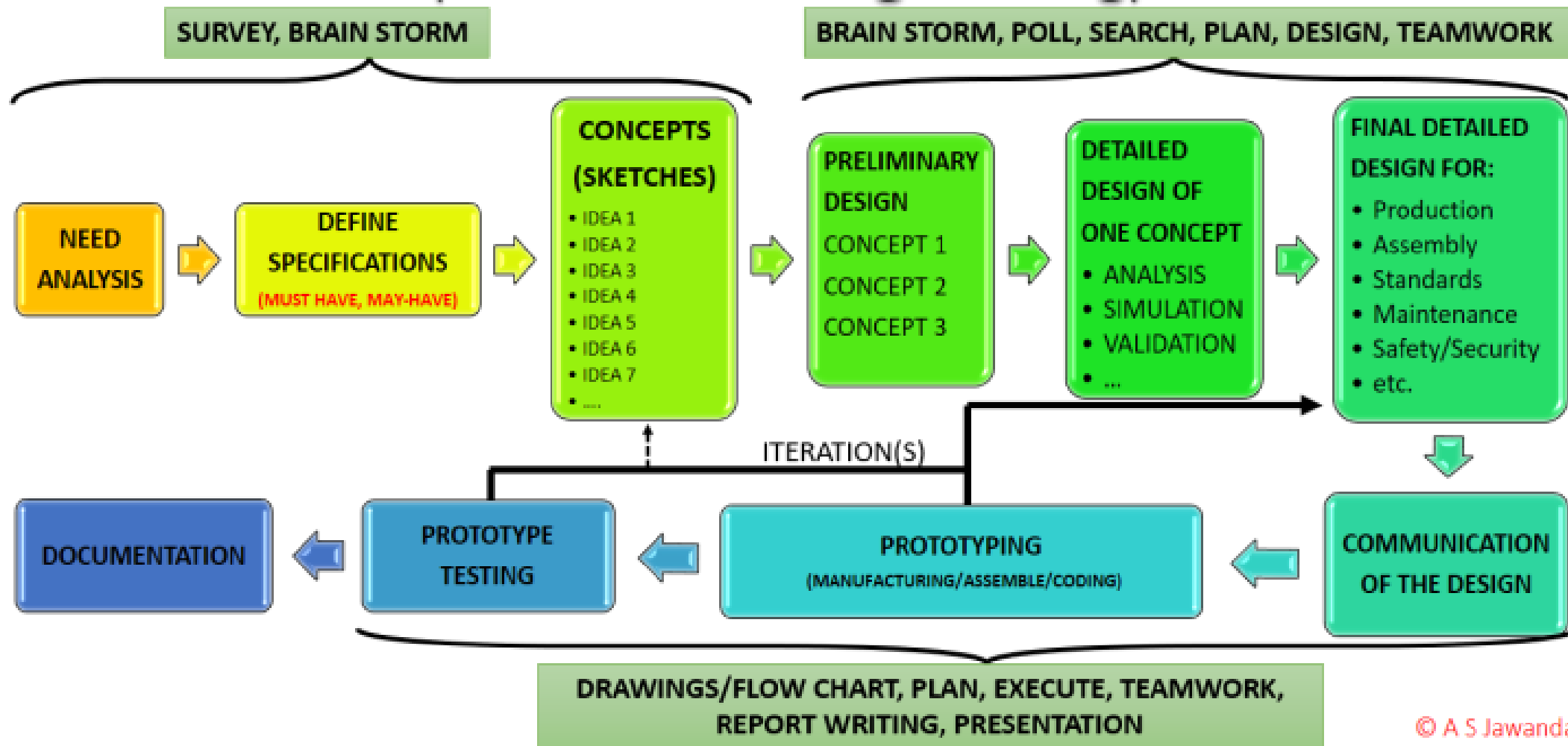- Perspective Challenges

Replaced

New Methodology

- Promote innovation

- Introduction to design
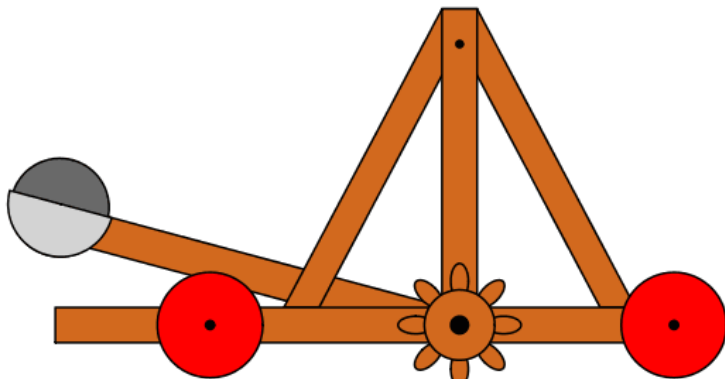
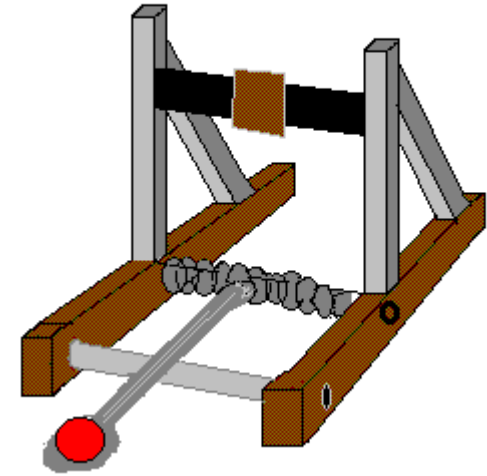- Promote independent thinking

- Group building

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Design Process : Central to all Engineering
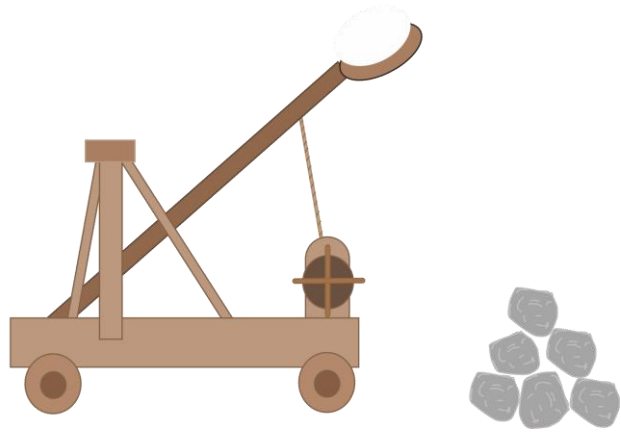
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Mangonel

- Mangonel can be considered as a special type of catapult, which was used in ancient times to throw large stones on opposition army and break large forte walls.

- Mangonel is derived from the Latin word "*manganon*" which means "*engine of war*".

- The Mangonel was invented by the Romans in 400 BC.
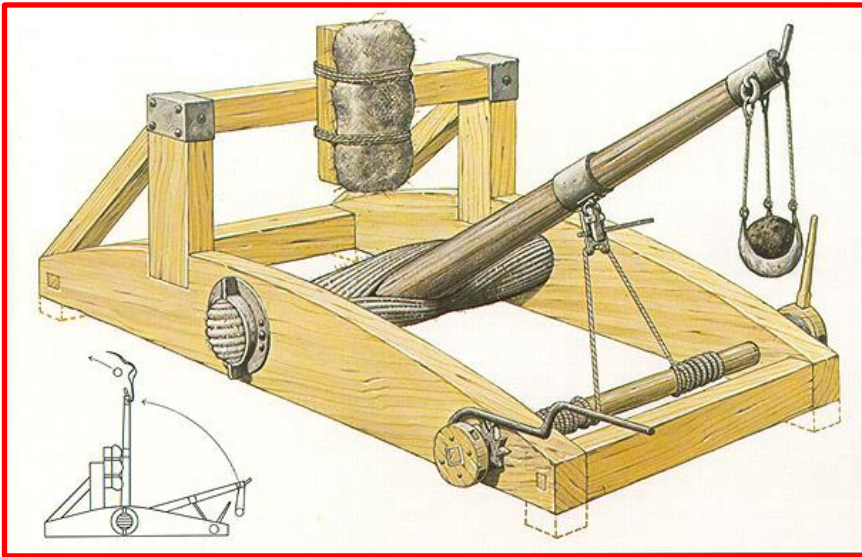
Figure : Schematic representation of Mangonel

Figure: Catapult (Slingshot)

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Figure: A small model Mangonel

Figure: A small model Mangonel

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Can we predict the distance?

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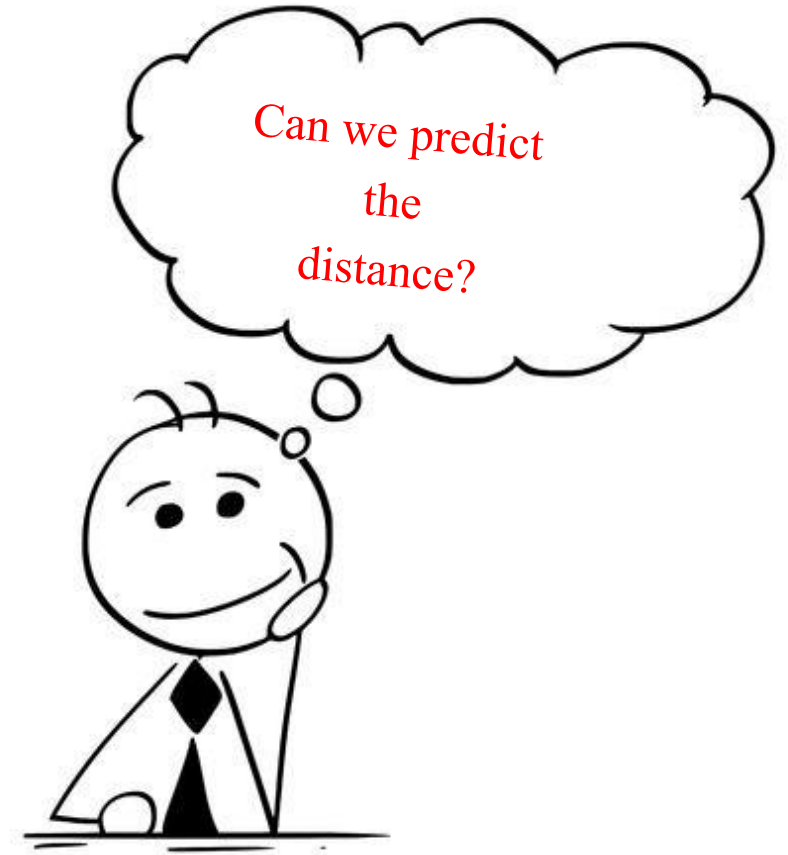
Factors that control the distance? (The dynamics)

Detailed Syllabus

UTA016

L	T	P	Cr
1	0	2	3.0

Course Objectives:

➢ To develop design skills according to a Conceive-Design-Implement- Operate (CDIO) compliant methodology.

➢ To apply engineering sciences through learning-by-doing project work.

➢ To provide a framework to encourage creativity and innovation.

➢ To develop team work and communication skills through group-based activity. To foster self- directed learning and critical evaluation.

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Scheme & Structure

➢ Course jointly offered by Mechanical and Electronics Engineering

➢ One lecture per week will cover various aspects of engineering

➢ 4 weeks each with Mechanical and Electronics in small groups

➢ Group project/Design of Catapult during the next 4 weeks

➢ Poster and report submission and Evaluation during the last week (Reading week before end sem exam)

Conti…

- ✓ 1000+ students

- ✓ Divided into two groups

- ✓ Group-1 only Mechanical Engineering Lectures and Practical's for first 4 weeks

- ✓ Group-2 only Electronics Engineering Lectures and Tutorials for first 4 weeks

- ✓ Group-1 and Group-2 swap from 9th week

- ✓ All groups move to the group project from 9th week

- ✓ 3/4 students per team

- ✓ Group poster/report submission during the last week

Week 1 starts: 25 July. 2022 (01:00 pm)
Week 5 starts: Whenever 4 turns of the Group completes in their respective Lab
Week 9: Completion of 4 turns in Mechanical and 4 turns in Electronics Dept.

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Thapar Institute of Engineering and Technology Patiala
Mechanical & Electronics Engineering Department
Session July – Dec 2022
UTA 016 ENGINEERING DESIGN PROJECT – I (MANGONEL)

Kindly find the below information related UTA016 course

It is mandatory to bring the laptop with fully charged battery and installed MS excel software to attend the Mechanical Practical / Electronics Labs

GROUP 1	GROUP 2
CO 1- 10 & CO 21-30	CO 11-20 & ENC 1-10
First 5 weeks in Mechanical Engineering Department	**First 5 weeks in Electronics & Communication Engineering Department**
(25th July 2022, 1 PM onwards to 29th Aug 2022 till 1 PM)	*(25th July 2022, 1 PM onwards to 29th Aug 2022 till 1 PM)*
Coordinator: Dr Vishal Gupta **Co-Coordinator Dr Sachin Singh**	**Coordinator: Dr Poonam Verma**
LECTURE SLOTS	
Monday 5:10 – 6:00 PM (Dr Vishal Gupta) **For Group 1 (COE 1- 10) LT 101**	**Monday 5:10 – 6:00 PM (Dr. Amit Munjal)** **For Group 2 (COE 11- 20) LT 103**
Tuesday 5:10 – 6:00 P (Dr Vishal Gupta) **For Group 1 (COE 21- 30) LT 101**	**Tuesday 5:10 – 6:00 PM (Dr. Poonam Verma)** **For Group 2 (NC 1- 10) LT 103**

Practical / LAB SLOTS

GROUP 1	Day	Time	Room
2CO1	Tuesday	8:00-9:40	T301
2CO2	Tuesday	8:00-9:40	T302
2CO3	Wed	1:50-3:30	T301
2CO4	Wed	1:50-3:30	T302
2CO5	Thursday	9:40-11:20	T301
2CO6	Thursday	9:40-11:20	T302
2CO7	Friday	1:50-3:30	T301
2CO8	Friday	1:50-3:30	T302
2CO9	Tuesday	1:50-3:30	T301
2CO10	Tuesday	1:50-3:30	T302
2CO21	Wed	11:20-1:00	T301
2CO22	Wed	11:20-1:00	T302
2CO23	Monday	8:00-9:40	T301
2CO24	Monday	8:00-9:40	T302
2CO25	Thursday	1:50-3:30	T301
2CO26	Thursday	1:50-3:30	T302
2CO27	Wed	8:00-9:40	T301
2CO28	Wed	8:00-9:40	T302
2CO29	Friday	11:20-1:00	T301
2CO30	Friday	11:20-1:00	T302

Group 2	Day	Time	Lab
2CO11	Tuesday	8:00-9:40	WMC Lab*
2CO12	Tuesday	8:00-9:40	AWP lab*
2CO13	Wed	1:50-3:30	WMC Lab
2CO14	Wed	1:50-3:30	AWP lab
2CO15	Thursday	9:40-11:20	WMC Lab
2CO16	Thursday	9:40-11:20	AWP lab
2CO17	Friday	1:50-3:30	WMC Lab
2CO18	Friday	1:50-3:30	AWP lab
2CO19	Tuesday	1:50-3:30	WMC Lab
2CO20	Tuesday	1:50-3:30	AWP lab
2NC1	Wed	11:20-1:00	WMC Lab
2NC2	Wed	11:20-1:00	AWP lab
2NC3	Monday	8:00-9:40	WMC Lab
2NC4	Monday	8:00-9:40	AWP lab
2NC5	Thursday	1:50-3:30	WMC Lab
2NC6	Thursday	1:50-3:30	AWP lab
2NC7	Wed	8:00-9:40	WMC Lab
2NC8	Wed	8:00-9:40	AWP lab
2NC9	Friday	11:20-1:00	WMC Lab
2NC10	Friday	11:20-1:00	AWP lab

Room No.: WMC Lab*: C211 and AWP Lab*: B203

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GROUP 1	Day	Time	Room
2CO1	Tuesday	8:00-9:40	T301
2CO2	Tuesday	8:00-9:40	T302
2CO3	Wed	1:50-3:30	T301
2CO4	Wed	1:50-3:30	T302
2CO5	Thursday	9:40-11:20	T301
2CO6	Thursday	9:40-11:20	T302
2CO7	Friday	1:50-3:30	T301
2CO8	Friday	1:50-3:30	T302
2CO9	Tuesday	1:50-3:30	T301
2CO10	Tuesday	1:50-3:30	T302
2CO21	Wed	11:20-1:00	T301
2CO22	Wed	11:20-1:00	T302
2CO23	Monday	8:00-9:40	T301
2CO24	Monday	8:00-9:40	T302
2CO25	Thrusday	1:50-3:30	T301
2CO26	Thrusday	1:50-3:30	T302
2CO27	Wed	8:00-9:40	T301
2CO28	Wed	8:00-9:40	T302
2CO29	Friday	11:20-1:00	T301
2CO30	Friday	11:20-1:00	T302

Group 2	Day	Time	Lab
2CO11	Tuesday	8:00-9:40	FOC Lab
2CO12	Tuesday	8:00-9:40	AWP lab
2CO13	Wed	1:50-3:30	FOC Lab
2CO14	Wed	1:50-3:30	AWP lab
2CO15	Thursday	9:40-11:20	FOC Lab
2CO16	Thursday	9:40-11:20	AWP lab
2CO17	Friday	1:50-3:30	FOC Lab
2CO18	Friday	1:50-3:30	AWP lab
2CO19	Tuesday	1:50-3:30	FOC Lab
2CO20	Tuesday	1:50-3:30	AWP lab
2NC1	Wed	11:20-1:00	FOC Lab
2NC2	Wed	11:20-1:00	AWP lab
2NC3	Monday	8:00-9:40	FOC Lab
2NC4	Monday	8:00-9:40	AWP lab
2NC5	Thrusday	1:50-3:30	FOC Lab
2NC6	Thrusday	1:50-3:30	AWP lab
2NC7	Wed	8:00-9:40	FOC Lab
2NC8	Wed	8:00-9:40	AWP lab
2NC9	Friday	11:20-1:00	FOC Lab
2NC10	Friday	11:20-1:00	AWP lab

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TUTORIALS & LABORATORY SCHEDULE

Title for the weekly work in 12 weeks of MED	Code	Week number	
Assignment 0: self learning home assignment	T0	W1/W6	Repeated after exchanged of groups with ECED
Development of simulator based on excel for dynamics of projectile launched by a Mangonel - No Drag	T1	W2/W7	
Development of simulator based on excel for dynamics of projectile launched by a Mangonel - With Drag	T2	W3/W8	
Design against failure under static actions	T3	W4/W9	
Design against failure under s dynamic actions	T4	W5/W10	

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LECTURE SCHEDULE

Lec No.	Topic	Contents	
Lec 1	INTRODUCTION and MANUFACTURING	The Mangonel Project. History. Manufacturing and assembling the Mangonel. Spreadsheet.	Repeated after reshuffling of groups
Lec 2	PROJECTILE MOTION	No DRAG, DRAG, Design spread sheet simulator for it	
Lec 3	STRUCTURES FAILURE	Static Loads	
Lec 4	STRUCTURES FAILURE	Dynamic Loads	
Lec 5/6	REDESIGNING THE MANGONEL	Project Introduction, constraints and limitations of materials for redesigning the Mangonel for precision.	
Lec 7/8	SIMULATION IN ENGINEERING DESIGN and ROLE OF MODELLING & PROTOTYPING	Simulation as an Analysis Tool in Engineering Design. The Role of Modeling in Engineering Design.	

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Course Learning Outcomes (CLOs)

Upon completion of this module, students will be able to:		
1.	simulate trajectories of a mass with and without aerodynamic drag using a spreadsheet based software tool to allow trajectories be optimised;	MED
2.	perform a test to acquire an engineering material property of strength in bending and analyse the throwing arm of the "Mangonel" under conditions of static and dynamic loading;	MED
3.	develop and test software code to process sensor data;	ECED
4.	design, construct and test an electronic hardware solution to process sensor data;	ECED
5.	construct and operate a Roman catapult "Mangonel" using tools, materials and assembly instructions, in a group, for a competition;	MED
6.	operate and evaluate the innovative redesign of elements of the "Mangonel" for functional and structural performance.	MED

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Evaluation Scheme

- 20 marks for MED assignments (4 assignments)

  (A1-5, A2-5, A3-5, A4-5)

- 30 marks for ECED Labs

- 20 marks for MED Assignment 5 : Group Project in, Testing and Reflection

  (Redesign poster-10, Individual viva-10)

- 10 marks for ECED Assignment 5 : Group Project in, Testing and Reflection

  (Redesign poster-10, Individual viva-10)

- 20 marks for Online Quiz

- Course Pass marks 50%

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Modules within project

Mechanical

A 'Precision Mangonel' is designed and instrumented with the aim of firing a missile (ball) at a target

Electronic

Design instrumentation which will allow the angular velocity and acceleration of the arm to be measured.

It Consists of
- Sensors fitted to Mangonel
- Logic design to control sensor outputs
- Software design of micro-processor
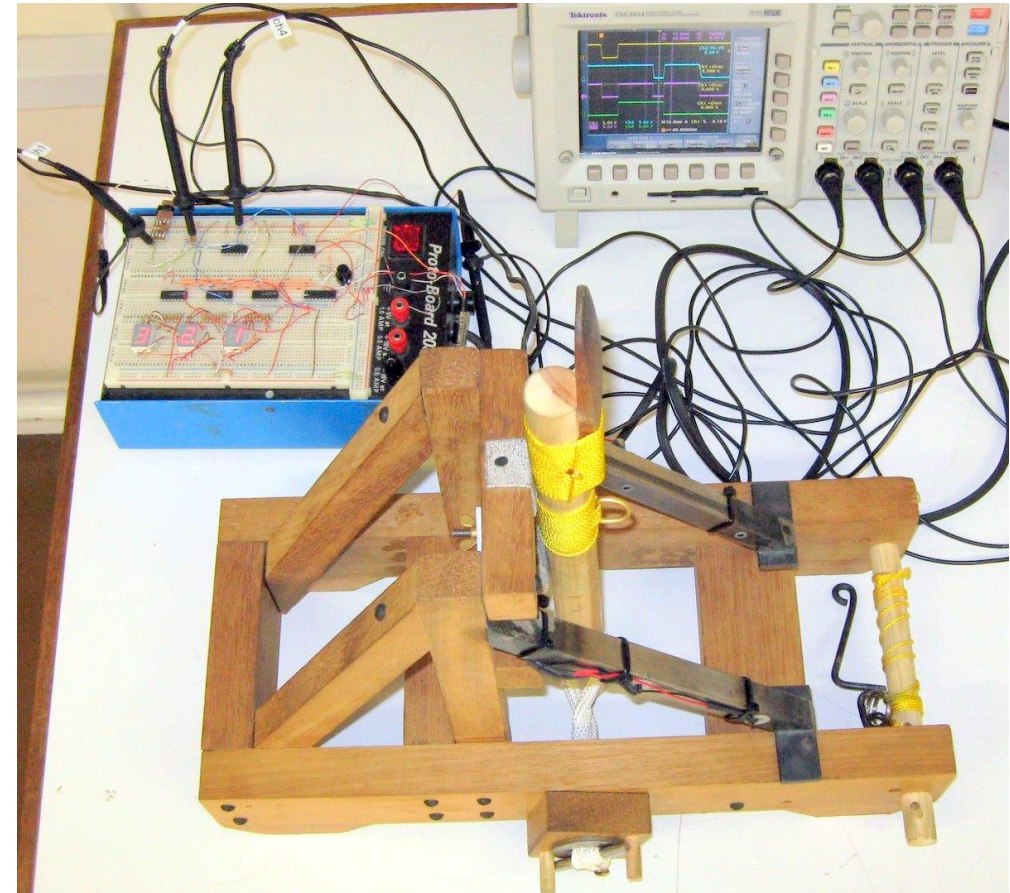- Assembly and operation of instrumentation to measure parameters on electronic display.

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Measure Arm Velocity

- *Instrumentation*

- *Software*

- *Hardware*

Result is a useful measurement tool

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MED TUTORIAL CLASS

Dedicated demonstrators in every engagement

BRINGING LAPTOP TO THE MED TUTORIAL CLASS IS COMPULSORY

Evaluation of the tutorial work will be done in the last 15 minutes of a tutorial class.
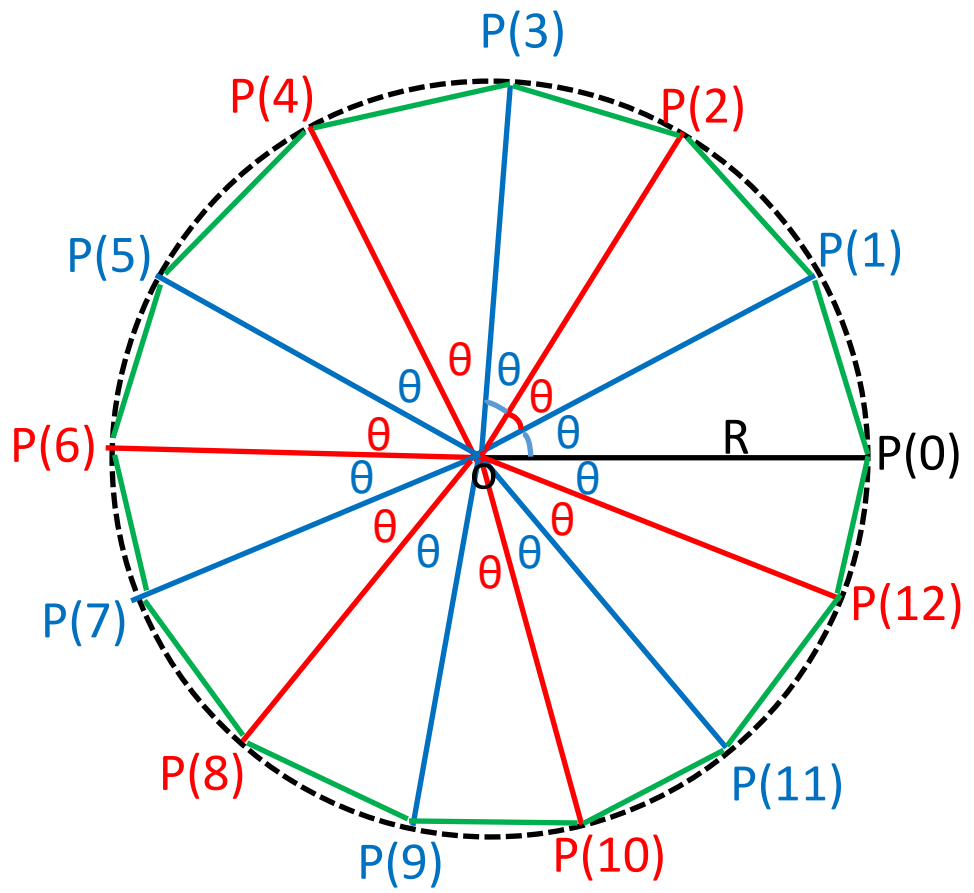
- Work Carried out in individually.
- When assignments are to be submitted individually work is not to be copied!
- The work will be marked during the lab/tut sessions

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General Notes

All Course details, Tutorial Assignments, Lectures, Announcements, online attendance forms on a course website accessible only through your @thapar.edu email ID.

Assignments

- Submission dates will be next week or announced.
- Late submissions marked out of 50% and not later than one week.
- If you don't come to the class or without laptop, you get zero for that assignment
- If you don't have a laptop, arrange one.

Course pass marks 50%

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SN/Position	Angle (θ) of position w.r.t. line O-P(0)	Px	Py
0/P(0)	0	R	0
1/P(1)	θ (0+θ)	R×cosθ	R×sinθ
2/P(2)	2θ (θ+ θ)	R×cos2θ	R×sin2θ
3/P(3)	3θ (2θ+ θ)	R×cos3θ	R×sin3θ
⋮			
358/P(358)	358	R×cos(358)	R×sin(358)
359/P(359)	359	R×cos(359)	R×sin(359)
360/P(360)	360	R×cos(360)=R	R×sin(360)=0

θ = 360/no of sides of regular polygon (N)

For the sake of simplicity

We shall take no of sides of polygon = 360

So that θ = 1 (degree)
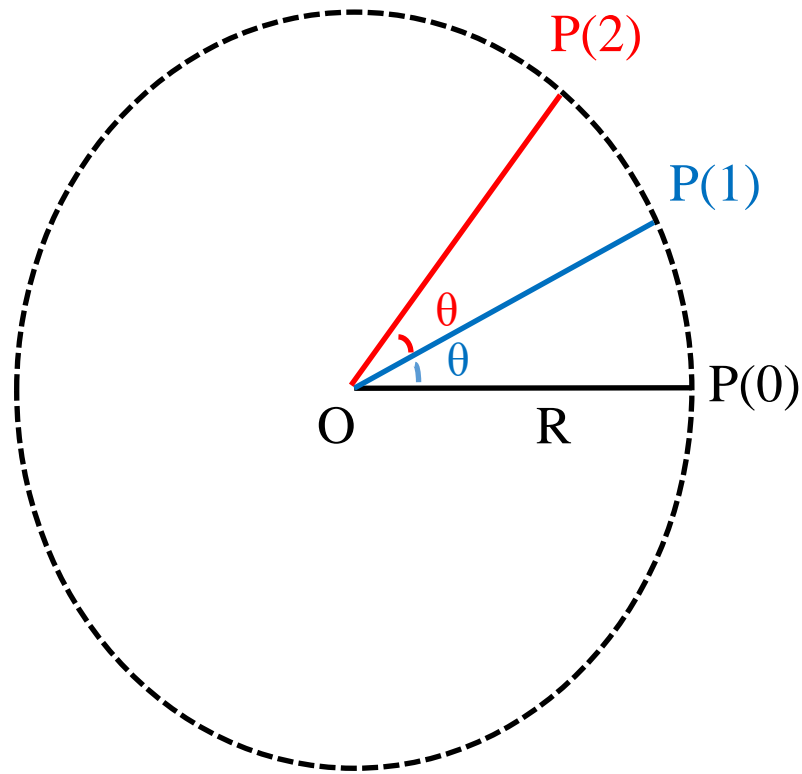
θ = 360/no of sides of regular polygon

For sake of simplicity
We shall take no of sides = 360
So that θ = 1 (degree)

Position	θ at different position Degree)	Px	Py
0	0	R	0
1	θ	R×cosθ	R×sinθ
2	2θ	R×cos2θ	R×sin2θ
360	360	R	0

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Thanks for attending this lecture

Save Tree Save World

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