Module (Course Syllabus) Catalogue

2023-2024

College/ Institute	Erbil Technology College	
Department	Construction and Materials Engineering technology department	
Module Name	Engineering Mechanics	
Module Code	ENM124	
Degree	**Technical Diploma** ☐ **Bachelor** ■ **High Diploma** ☐ **Master** ☐ **PhD** ☐	
Semester	**2**	
Qualification	**Doctorate**	
Scientific Title	**Lecturer**	
ECTS (Credits)	**7**	
Module type	**Prerequisite** ☐ **Core** ■ **Assist.** ☐	
Weekly hours		
Weekly hours (Theory)	**(3)hr Class**	**(189)Total hrs Workload**
Weekly hours (Tutorial)	**(2)hr Class**	
Number of Weeks	**12**	
Lecturer (Theory)	**Dr. Guler Fakhraddin Muhyaddin**	
E-Mail & Mobile NO.	**guler.muhyaddin@epu.edu.iq** **(07504480587)**	
Websites		

Course Book

Course Description	This is your first course in Engineering Mechanics, which is the study of the interaction of matter and forces in engineering contexts. It is evident that all objects in the world around us are composed of matter, and they are all subject to forces. As such, Engineering Mechanics is the foundational tool for engineers, and forms the underlying basis for understanding more advanced fields such as Solid Mechanics, Fluid Dynamics, Rigid Body Dynamics, Aerodynamics, Structures, Control and many aspects of Advanced Design.
Course objectives	In this course students will learn a process for analysis of static objects; concepts of force, moment, and mechanical equilibrium; how to analyze forces and moments in two and three dimensions; and how to analyze distributed forces and internal loads. They will be able to analyze forces in various systems such as frames, machines, trusses, beams and cables. The tools learned in this course will provide the basis for later courses and a career in engineering.
Student's obligation	Attending the lecture is a fundamental part of the course. You are responsible for material presented in the lecture whether or not it is discussed in the textbook. You should expect questions on the exams to test your understanding of concepts discussed in the lecture and in the homework assignments. It can be very helpful to study with a group. This type of cooperative learning is encouraged; however, be sure that you have a thorough understanding of the concepts besides the mathematical steps used to solve a problem. You must be able to work through the problems on your own.
Required Learning Materials	In the lecture during the academic study, am using (data show) for giving full detailing, beside that will be using the white board to solution the examples, and giving the students a hard copy of the lecture, finally, I will give the students a take home.

Evaluation	Task		Weight (Marks)	Due Week	Relevant Learning Outcome
	Paper Review				
	Assignments	Homework	14%		
		Class Activity	2%		
		Report	24%		
		Seminar			
		Essay			
		Project			
	Quiz		4%		
	Lab.				
	Midterm Exam		16%		
	Final Exam		40%		
	Total		100%		

Specific learning outcome:

- **Specific learning outcome:**

Learning outcomes of the course are that students will:

1. Use a standard process for analyzing static objects.
2. Define a force and a moment.
3. Add forces and moments in two and three dimensions, and find a component of a force or moment in a given direction.
4. Construct free body diagrams of an object or a system of connected objects.
5. Describe conditions of equilibrium and their associated component equations.
6. Use conditions of equilibrium and known forces and moments to solve for unknown external and internal forces and moments present in an object of system of connected objects.
7. Define statically determinate, statically indeterminate, and under-constrained systems, and identify systems having these characteristics.
8. Calculate the center of gravity, center of mass, and centroid for simple and composite volumes.
9. Represent a distributed line or area load by an equivalent point force, and use the equivalent point force in static analysis.

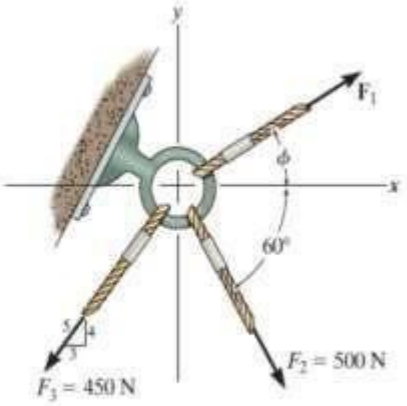
Define, identify, and carry out equilibrium analysis of frames, machines, trusses, beams and cables.

Course References:	[1] Engineering Mechanics: Statics & Dynamics, (12th Ed.), R.C. Hibbeler, 2012 (Major)
	[2] Engineering Mechanics: Statics (7th Ed.), J.L. Meriam and L.G. Kraige, 2012 (Major)

Course topics (Theory)	Week	Learning Outcome
Introduction to statics; vectors; units; force Systems.	Week 1	General Principles
Force Vectors	Week 2	Force Vectors Ch. 1 and Ch. 2
Equilibrium of a Particle	Week 3	Force System
Force System Resultants	Week 4	Ch. 3 and Ch. 4
Equilibrium of a Rigid Body	Week 5	Structural Analysis Ch. 5 and Ch. 6
Frames and Machines; Distributed forces; centroids and mass centres;	Week 6	Internal Forces
Midterm Exam	Week 7	
Beams; internal and external effects; shear force and bending moment diagrams	Week 8	Calculating forces in a specified point
Friction; static and dynamic coefficients; wedges, screws, bearings	Week 9	Understand contact friction cases Ch. 7 and Ch. 8
Canter of Gravity and Centroid	Week 10	
Moments of Inertia	Week 11	
Virtual Work	Week 12	Ch. 9, Ch. 10, and Ch. 11
Review and solved examples	Week 13	

Questions Example Design and answers:

•2–33. If $F_1 = 600\,\text{N}$ and $\phi = 30°$, determine the magnitude of the resultant force acting on the eyebolt and its direction measured clockwise from the positive x axis.



Rectangular Components: By referring to Fig. *a*, the x and y components of each force can be written as

$$(F_1)_x = 600\cos 30° = 519.62\,\text{N} \quad (F_1)_y = 600\sin 30° = 300\,\text{N}$$
$$(F_2)_x = 500\cos 60° = 250\,\text{N} \quad (F_2)_y = 500\sin 60° = 433.0\,\text{N}$$
$$(F_3)_x = 450\left(\frac{3}{5}\right) = 270\,\text{N} \quad (F_3)_y = 450\left(\frac{4}{5}\right) = 360\,\text{N}$$

Resultant Force: Summing the force components algebraically along the x and y axes,

$$\stackrel{+}{\rightarrow}\Sigma(F_R)_x = \Sigma F_x; \quad (F_R)_x = 519.62 + 250 - 270 = 499.62\,\text{N} \rightarrow$$
$$+\uparrow \Sigma(F_R)_y = \Sigma F_y; \quad (F_R)_y = 300 - 433.01 - 360 = -493.01\,\text{N} = 493.01\,\text{N} \downarrow$$

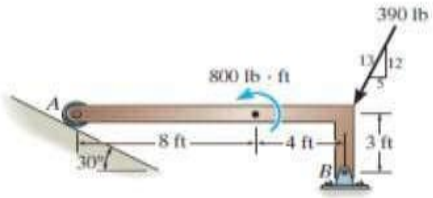
The magnitude of the resultant force $\mathbf{F}_R$ is

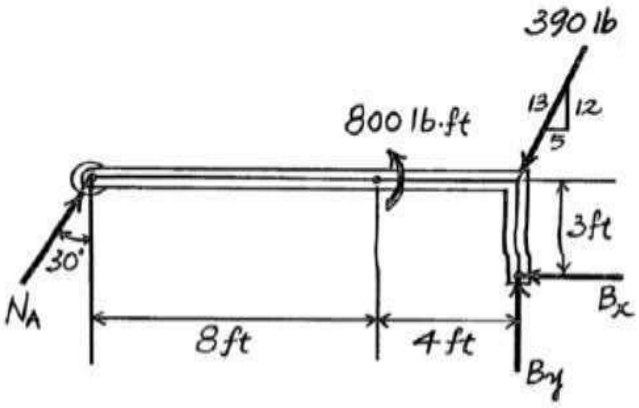
$$F_R = \sqrt{(F_R)_x^2 + (F_R)_y^2} = \sqrt{499.62^2 + 493.01^2} = 701.91\,\text{N} = 702\,\text{N} \quad \textbf{Ans.}$$

The direction angle θ of $\mathbf{F}_R$, Fig. *b*, measured clockwise from the x axis, is

$$\theta = \tan^{-1}\left[\frac{(F_R)_y}{(F_R)_x}\right] = \tan^{-1}\left(\frac{493.01}{499.62}\right) = 44.6° \quad \textbf{Ans.}$$

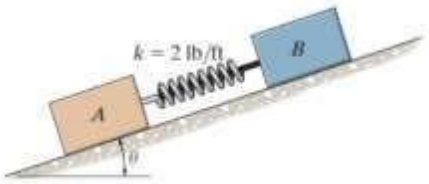
5–2. Draw the free-body diagram of member AB, which is supported by a roller at A and a pin at B. Explain the significance of each force on the diagram. (See Fig. 5–7*b*.)





N_A force of plane on roller.
B_x, B_y force of pin on member.

*8–20. Two blocks A and B have a weight of 10 lb and 6 lb, respectively. They are resting on the incline for which the coefficients of static friction are $\mu_A = 0.15$ and $\mu_B = 0.25$. Determine the angle θ which will cause motion of one of the blocks. What is the friction force under each of the blocks when this occurs? The spring has a stiffness of $k = 2$ lb/ft and is originally unstretched.



Equations of Equilibrium : Since Block A and B is either not moving or on the verge of moving, the spring force $F_{sp} = 0$. From FBD (a),

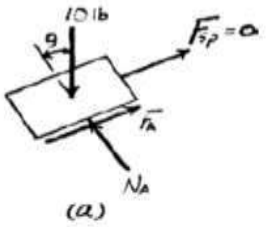
$$+\nearrow \Sigma F_x = 0; \quad F_A - 10\sin\theta = 0 \qquad [1]$$

$$+\nwarrow \Sigma F_y = 0; \quad N_A - 10\cos\theta = 0 \qquad [2]$$

From FBD (b),

$$+\searrow \Sigma F_x = 0; \quad F_B - 6\sin\theta = 0 \qquad [3]$$

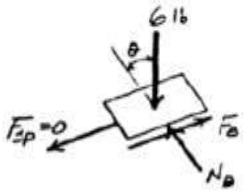
$$+\nwarrow \Sigma F_y = 0; \quad N_B - 6\cos\theta = 0 \qquad [4]$$



(a)

Friction : Assuming block A is on the verge of slipping, then

$$F_A = \mu_{s,A} N_A = 0.15 N_A \qquad [5]$$



Solving Eqs. [1], [2], [3], [4] and [5] yields

$$\theta = 8.531° \quad N_A = 9.889 \text{ lb} \quad F_A = 1.483 \text{ lb}$$
$$F_B = 0.8900 \text{ lb} \quad N_B = 5.934 \text{ lb}$$

Since $(F_B)_{max} = \mu_{s,B} N_B = 0.25(5.934) = 1.483 \text{ lb} > F_B$, block B does not slip. Therefore, the above assumption is correct. Thus

$$\theta = 8.53° \quad F_A = 1.48 \text{ lb} \quad F_B = 0.890 \text{ lb} \qquad \text{Ans}$$

Extra notes:

A sample of exam paper and its answer will be attached. For the students to be familiar with exam.

External Evaluator

The course book prepared by my colleague is properly arranged and covers the main requirements of the lesson. The lecturing procedures are identified properly. The assessment scheme and forms of teaching are arranged in a way that the student could understandclearly. It can be said that student will be satisfied with this course book and it promises a good outcome.

Approved

Dr. Saad Khalis Essa