# Module (Course Syllabus) Catalogue

# 2023-2024

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| College/ Institute | Erbil Technology College | |
| Department | Road Construction Department | |
| Module Name | ENGINEERING MECHANICS | |
| Module Code | ENM 203 | |
| Degree | Technical Diploma [x] Bachelor [ ]<br>High Diploma [ ] Master [ ] PhD [ ] | |
| Semester | Semester 2 | |
| Qualification | Ph.D. in Civil/Environmental Engineering | |
| Scientific Title | Assistant Professor | |
| ECTS (Credits) | 6 | |
| Module type | Prerequisite [ ] Core [x] Assist. [ ] | |
| Weekly hours | 4 hrs. | |
| Weekly hours (Theory) | ( 2 )hr Class | ( 2 )Total hrs Workload |
| Weekly hours (Practical) | ( )hr Class | (161)Total hrs Workload |
| Number of Weeks | 16 | |
| Lecturer (Theory) | / | |
| E-Mail & Mobile NO. | / | |
| Lecturer (Practical) | Dr.Abdulfattah Ahmad Amin Al-Najjar | |
| E-Mail & Mobile NO. | abdulfattah.amin@epu.edu.iq | |
| Websites | / | |

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| **Corse Description** | The design of this module includes establishing improving the student's knowledge and understanding about the engineering mechanics to provide the student realistic applications encountered in professional practice. The topics of this module includes: basic concepts of engineering mechanics, forces systems and a force analysing, drawing of free body diagrams and determine the resultant of forces and/or moments. Draw complete and correct free-body diagrams and write the appropriate equilibrium equations from the free-body diagram. Determine the support reactions on a structure. Determine the connection forces in trusses and in general frame structures. Determine the centroid. Analyse statically determinate planar frames. The module will be delivered via lectures and tutorials (supported by problem-solving classes). |
| **Course objectives** | **The general objectives of this module are:**<br>- Understand the theory of engineering mechanics to tackle real live engineering problems<br>- Apply principles of statics to solve engineering problems.<br>- Involve in team working and collaborate with colleagues. |
| **Student's obligation** | To pass this module the students should attend all lectures and complete all tests, exams and assignments. |
| **Required Learning Materials** | Forms of teaching<br>Oral presentations lectures, Group discussions, Seminars, Problem-solving based learning, Project based learning |

**Evaluation**

| Task | | Weight (Marks) | Due Week | Relevant Learning Outcome |
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| Paper Review | | / | | |
| Assignments | Homework | 10 | 1-12 | Improve to solving problems |
| | Class Activity | 6 | 1-12 | To analyze and solve engineering mechanics problems |
| | Report | 8 | | To learn how to write technical reports |

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| | | Seminar | 8 | 1-12 | Improve the ability of presentation |
| | | Essay | / | | |
| | | Project | / | 1-12 | |
| | Quiz | | 8 | 1-12 | |
| | Lab. | | / | | |
| | Midterm Exam | | 20 | 1-12 | |
| | Final Exam | | 40 | 1-12 | |
| | Total | | 100 | | |
| **Specific learning outcome:** | *On successful completion of this module the learner will be able to:*<br>1. **Recognize** basic concepts of engineering mechanics<br>2. **Identify** quantify all types of forces systems and **analyze** forces into components<br>3. **Determine** and **apply** concepts of moment of forces and couples<br>4. **Develop** and **sketch** free body diagrams for different structures and elements of structures<br>5. **Determine** resultants and **apply** conditions of static equilibrium to plane force systems<br>6. **Analyze** frames and trusses using equilibrium equations.<br>7. **Apply** concepts of first moment of area and **locate** centroid of different types areas<br>8. **Collaborate** with others to solve problems by group or team working. | | | | |
| **Course References:** | - Lecture notes.<br>- R. C. Hibbler, Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press, 2006.<br>- Hibbler, R.C and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", 11th Edition, Pearson Education (2010).<br>- Kumar, K.L., "Engineering Mechanics", 3rd Revised Edition, Tata McGraw-Hill Publishing company, New Delhi (2008) | | | | |

| Course topics (Theory) | Week | Learning Outcome |
|---|---|---|
| Introduction | Week 1 | ***1*** |
| Forces Systems | Week 2 | ***1 , 2 and 8*** |
| Moment of forces | Week 3 | ***3 and 8*** |
| Couples | Week 4 | ***3*** |
| Equilibrium of rigid bodies- Conditions and Free body diagram (F.B.D) | Week 5 | ***1,2, 4 and 8*** |
| Equations of Equilibrium- Two forces members | Week 6 | ***2, 3 , 4 and 5*** |
| Midterm Examination | **Week 7** | |
| Midterm Examination | Week 8 | |
| Equations of Equilibrium- Three forces members | Week 9 | ***4 , 5 and 6*** |
| Equations of Equilibrium- Three forces members | Week 10 | ***5, 6 and 8*** |
| Distributed loads | Week 11 | ***4 , 8*** |
| Trusses- Joints method | Week 12 | ***4, 5 and 6*** |
| Trusses- Sections Method | Week 13 | ***4, 5 and 6*** |
| Centroid | Week 14 | ***2, 7 and 8*** |
| Final Examination | Week 15 | |
| Final Examination | Week 16 | |
| **Practical Topics** | **Week** | **Learning Outcome** |
| N. A | | |
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- **Examinations (question design):**

**The following is an example of the examination and its answer:**

Ministry of Higher Education and Scientific Research
Erbil Polytechnic University (EPU)
Erbil Technology College (ETI)
Dept. of Surveying and Road Construction / Road Branch

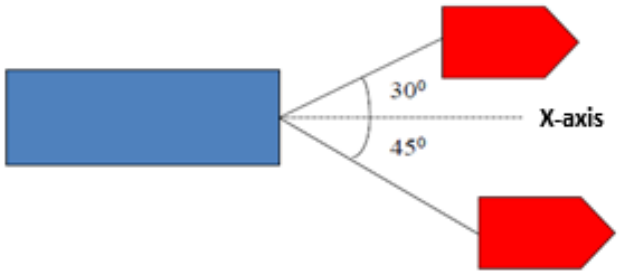
Academic Year 2021 – 2022
(Mid-Term Exam-Morning)

Stage: 1st – 2nd Semester (S2)
Subject: Engineering Mechanics
Time: 90 Minutes
Date: Thu. 21/04/2022
Code: ENM 203

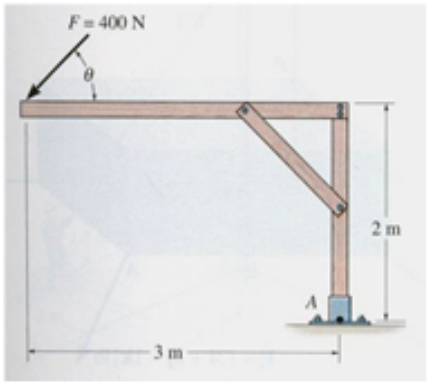
NOTE: any number without unit will be neglected and calculator device is allowed.

Q1/ Convert: (a) 200 lb.ft to N.m , (b) 300 lb/ft$^3$ to kN/m$^3$, (c) 10 ft/h to mm/s ? (25 Marks)

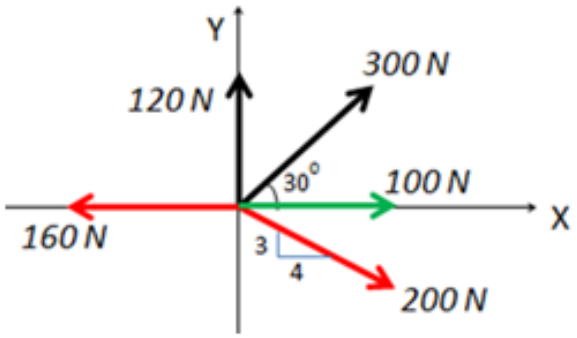
Q2/ A barge is pulled by two tugboats. If the resultant of the forces exerted by the tugboat is a 6500 KN force directed along the axis of the barge, determine the tension in the ropes? (25 Marks)




Q3/ A 400 N force is applied to the frame in the figure below and θ = 20°. Find the moment of the force F at A? (25 Marks)



**Q4/ Determine the resultant "R" and θ of the force system shown in the below figure?**




**(25 Marks)**

Dr. Abdulfattah Ahmad Amin

Lecturer

**Mid-Term Typical Answers ( ENGINEERING MECHANICS) S2 21/4/2022 1st stage**

**Q1/ Convert: (a) 200 lb.ft to N.m , (b) 300 lb/ft³ to kN/m³ , (c) 10 ft/h to mm/s ?**

**Solution: -**

**a) 200 lb.ft to N.m ?**

**200 lb ⇒ ∵ 1 lb = 4.4482 N ⇒ ∴ 200 lb = 889.64 N , ∵ 1 ft = 0.3048 m**

**∴ 200 lb. ft = (889.64 N)*(0.3048 m) = 271.16227 N.m**

**b) 300 lb/ft³ to kN/m³ ?**

**300 lb ⇒ ∵ 1 lb = 4.4482 N = 0.0044482 KN ⇒ ∴ 300 lb = 1.33446 KN**

**∵ 1 ft = 0.3048 m ⇒ 1³ ft³ = (0.3048)³ m³ ⇒ 1³ ft³ = 0.02831685 m³**

**∴ 300 lb/ft³ = (1.33446 KN / 0.02831685 m³) = 47.1267 KN/ m³**

**c) 10 ft/h to mm/s ?**

**∵ 1 ft = 0.3048 m ⇒ 1 ft = (0.3048 m*1000 mm/m) =304.8 mm**

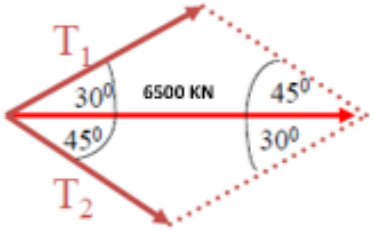
**∴ ⇒ 10 ft = 10 * 304.8 mm = 3048 mm**

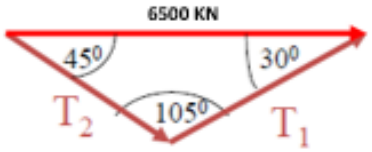
**∵ hr = (60 min*60 sec/min) = 3600 sec**

**∴ 10 ft/h = (3048 mm/3600 sec) = 0.84667 mm/sec**

**Q2/**

# Solution




$$\frac{T_1}{\sin 45^0} = \frac{T_2}{\sin 30^0} = \frac{6500\ KN}{\sin 105^0}$$

$$\frac{T_1}{\sin 45^0} = \frac{6500\ KN}{\sin 105^0}$$

⇒ **$T_1$**= (6500 KN * sin 45°) / sin 105° = (6500*0.7071)/0.966 = (4596.15 / 0.966)

**$T_1 = 4757.92$ KN**

$$\frac{T_2}{\sin 30^0} = \frac{6500\ KN}{\sin 105^0}$$

⇒ **$T_2$**= (6500 KN * sin 30°) / sin 105° = (6500*0.5)/0.966 = (3250 / 0.966)

**$T_2 = 3364.39$ KN**

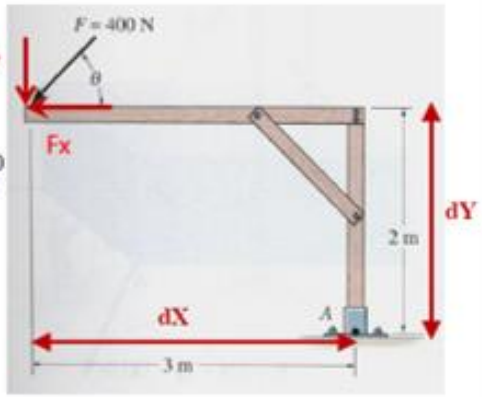
**Q3/ solution**

## Solution:

$F_x = F\cos\theta$ $\quad F_y = F\sin\theta$

$F_x = 400\,N\cos 20^0$ $\quad F_y = 400\,N\sin 20^0$

$F_x = 375.877\,N$ $\quad F_y = 136.80\,N$




Using Varignon's theorem,

$$M_A = F_x.dy + F_y.dx$$

We can determine the direction of rotation by imagining the body pinned at A and deciding which way the body would rotate because of the force.

$$M_A = (375.877\,N)(2\,m) + (136.80\,N)(3\,m)$$

$$= 751.74\ \text{N m} + 410.40\ \text{N m}$$

$$M_A = 1162\,N.m$$

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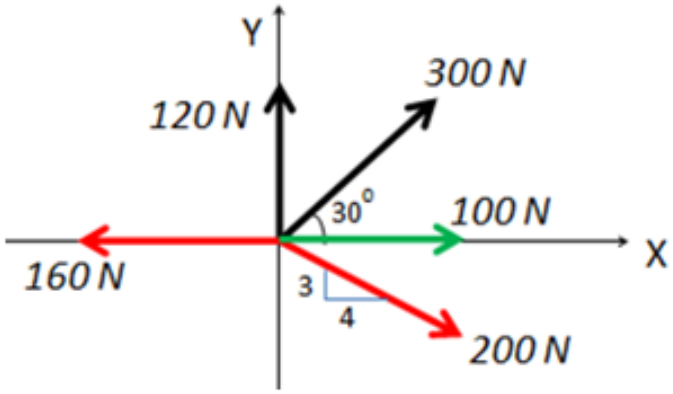
**Q4/**




***Solution:***

$F_{Rx} = \sum F_x \rightarrow +$

$F_{Rx} = 100\ N + 300\ \cos 30^\circ N + 4 \times \frac{200}{5}\ N - 160\ N$

$F_{Rx} = 100\ N + 259.81\ N + 160\ N - 160\ N$

$F_{Rx} = 359.81\ N \rightarrow$

$F_{Ry} = \sum F_y + \uparrow$

$F_{Ry} = 120\ N + 300\ \sin 30^\circ N - 3 \times \frac{200}{5}\ N$

$F_{Ry} = 120\ N + 150\ N - 120\ N$

$F_{Ry} = 150\ N \uparrow$

$F_R = \sqrt{(359.81)^2 + (150)^2}$

$F_R = 389.82\ N \nearrow$

$\theta = \tan^{-1}\left(\frac{150}{359.81}\right) = 22.63^\circ$

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| -<br>- **Extra notes:** | | |
| **This Course catalogue has been prepared by:**<br><br>1- Assist. Prof. Dr. Khaleel Hasan Younis<br>2- Assist. Prof. Dr. Abdulafattah Ahmed Amin.<br><br>- **External Evaluator:**<br>Assist. Prof. Dr. Ganjeena Jalal Medhat | | |