



| Department offering the program:       Department of Aerospace Engineering         Department offering the course:       Department of Aerospace Engineering         Cademic Level:       B.Sc.         Date       March 23 2015         Semester (based on final exam timing)       Ix Fall         Semester (based on final exam timing)       Ix Fall         I. Title:       Plasticity         Code:       AER 638         2. Units/Credit<br>nours per week:       Lectures         3. Total       45         B- Professional Information       This course is intended to introduce the basic concepts of metallic materials plasticity<br>plastic flow, plastic flow rate , plastic hardening, plastic constitutive model , theories of<br>computing stress and total strain associated with plastic deformation with application to<br>engineering structures analysis and design         a) Knowledge and Understanding       To know the importance of considering plasticity phenomena in structures design damage<br>To understan |   |             |  |                                     | Course Spe     | ecification   | ns          |          |          |                 |            |
|--|---|-------------|--|-------------------------------------|----------------|---------------|-------------|----------|----------|-----------------|------------|
| Department of fering the course:       Department of Aerospace Engineering         Academic Level:       B.Sc.         Date       March 23 2015         Semester (based on final exam timing)       IX Fall         Spring       Spring         A- Basic Information       IX Fall         I. Title:       Plasticity         Code:       AER 638         2. Units/Credit<br>nours per week:       Lectures         B- Professional Information       15         B- Professional Information         I. Course description:         This course is intended to introduce the basic concepts of metallic materials plasticity plastic flow, plastic flow rate , plastic hardening, plastic constitutive model , theories of computing stress and total strain associated with plastic deformation with application to engineering structures analysis and design         a) Knowledge and Understanding         To know the importance of considering plasticity phenomena in structures design damage         To understand basic differences between stress dependent, plasticity, time dependent and rate dependent plasticity.         b) Intellectual Skills         To learn the monolithic materials theories for calculating plastic deformation , plasti strain increment, plastic strain flow and plastic strain flow rate as function of stress, tim and rate of application, plasticity constitutive relationships and models.                            | Program(s) on which this course is given: |             |  | Aerospace Engineering               |                |               |             |          |          |                 |            |
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| 2. Units/Credit<br>nours per week:       Lectures       27       Tutorial       15       Practical       3       Total       45         B- Professional Information       This course is intended to introduce the basic concepts of metallic materials plasticity<br>plastic flow, plastic flow rate , plastic hardening, plastic constitutive model , theories of<br>computing stress and total strain associated with plastic deformation with application to<br>engineering structures analysis and design         a) Knowledge and Understanding       To know the importance of considering plasticity phenomena in structures design damage<br>To understand basic differences between stress dependent, plasticity, time dependent and<br>rate dependent plasticity.         b) Intellectual Skills         To learn the monolithic materials theories for calculating plastic deformation , plastis<br>strain increment, plastic strain flow and plastic strain flow rate as function of stress, tim<br>and rate of application, plasticity constitutive relationships and models.  |   |             |  | ining)                              |                | spi           |             |          |          |                 |            |
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| I. Course description:This course is intended to introduce the basic concepts of metallic materials plasticity<br>plastic flow, plastic flow rate , plastic hardening, plastic constitutive model , theories of<br>computing stress and total strain associated with plastic deformation with application to<br>engineering structures analysis and designa) Knowledge and UnderstandingTo know the importance of considering plasticity phenomena in structures design damage<br>To understand basic differences between stress dependent, plasticity, time dependent and<br>rate dependent plasticity.b) Intellectual SkillsTo learn the monolithic materials theories for calculating plastic deformation , plastic<br>strain increment, plastic strain flow and plastic strain flow rate as function of stress, time<br>and rate of application, plasticity constitutive relationships and models.   | hours per week:                           | Lectures 21 |  | 21                                  |                |               | Tractical 5 |          | 5        | Total           | 45         |
| I. Course description:plastic flow, plastic flow rate , plastic hardening, plastic constitutive model , theories of computing stress and total strain associated with plastic deformation with application to engineering structures analysis and designa) Knowledge and UnderstandingTo know the importance of considering plasticity phenomena in structures design damageTo understand basic differences between stress dependent, plasticity, time dependent and rate dependent plasticity.b) Intellectual SkillsTo learn the monolithic materials theories for calculating plastic deformation , plastic strain increment, plastic strain flow and plastic strain flow rate as function of stress, time and rate of application, plasticity constitutive relationships and models.  | <b>B- Professiona</b>                     | al Inform   |  |                                     | ntended to int | troduce the   | hasic cor   | ncents ( | of metal | lic materials r | alasticity |
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| <ul> <li>rate dependent plasticity.</li> <li>b) Intellectual Skills</li> <li>To learn the monolithic materials theories for calculating plastic deformation , plastic strain increment, plastic strain flow and plastic strain flow rate as function of stress, time and rate of application, plasticity constitutive relationships and models.</li> </ul>   |   |             | To know the importance of considering plasticity phenomena in structures design damage   |                                     |                |               |             |          |          |                 |            |
| 2. Intended Learning Course To learn the monolithic materials theories for calculating plastic deformation , plastic strain increment, plastic strain flow and plastic strain flow rate as function of stress, time and rate of application, plasticity constitutive relationships and models.   |   |             | To understand basic differences between stress dependent, plasticity, time dependent and rate dependent plasticity.  |                                     |                |               |             |          |          |                 |            |
| 2. Intended Learning Strain increment, plastic strain flow and plastic strain flow rate as function of stress, time and rate of application, plasticity constitutive relationships and models.   |   |             | b) Intellectual Skills   |                                     |                |               |             |          |          |                 |            |
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|  | (ILOs):                                   | 000000      |  |                                     |                |               |             |          |          |                 |            |
| c) Professional and Practical Skills   |   |             | c) Professional and Practical Skills   |                                     |                |               |             |          |          |                 |            |
| Application of plasticity calculations to engineering components design  |   |             | Application of plasticity calculations to engineering components design  |                                     |                |               |             |          |          |                 |            |
| Plastic deformation effects on aerospace structures and engines performance and strength   |   |             | Plastic deformation effects on aerospace structures and engines performance and strength   |                                     |                |               |             |          |          |                 |            |
| d) General and Transferable Skills   |   |             | d) General and Transferable Skills   |                                     |                |               |             |          |          |                 |            |
| Plastic deformation inspection   |   |             | Plastic deformation inspection   |                                     |                |               |             |          |          |                 |            |
| 3. Contents  | 3. Contents                               |             |  |                                     |                |               |             |          |          |                 |            |

| Торіс  | Total hours | Lectures hours | Tutorial/ Practical hours |
|--|-------------|----------------|---------------------------|
| Stress, time and rate dependent plastic damage and deformation                                       |             | 3              |                           |
| Variation of material properties with plasticity   |             | 3              |                           |
| Theories of plastic deformation, plastic<br>flow and plastic flow rate constitutive<br>relationships |             | 9              | 9                         |
| Limit analysis and shake down theories   |             | 3              |                           |
| Application of plasticity calculations to truss and frame structures.                                |             | 6              | 6                         |
| Applying plasticity calculations to finite   |             | 3              | 3                         |

| element structural analysis           |                          |  |                      |  |  |
|---------------------------------------|--------------------------|--|----------------------|--|--|
|                                       | Lectures (27)            | Practical Training/<br>Laboratory (15) | Seminar/Workshop (3) |  |  |
| 4. Teaching and Learning Methods      | Class Activity<br>(4)    | Case Study (1)                         | Projects (1)         |  |  |
|                                       | E-learning (2)           | Assignments /Homework (5)              | Other:               |  |  |
| 5. Student Assessment Methods         |                          |  |                      |  |  |
| Assessment Schedule                   |                          | Week                                   |                      |  |  |
| -Assessment 1;Class test              |                          | 4,5,6                                  |                      |  |  |
| -Assessment 2; Project Assignment     |                          | 7                                      |                      |  |  |
| -Assessment 3; Presentations          |                          | 10                                     |                      |  |  |
| -Assessment 3; Midterm Exam           |                          | 9                                      |                      |  |  |
| -Assessment 4; Final Exam             |                          | 16                                     |                      |  |  |
| • Weighting of Assessments            |                          |  |                      |  |  |
| -Mid-Term Examination                 |                          | 20                                     |                      |  |  |
| -Final-term Examination               |                          | 40                                     |                      |  |  |
| -Project                              |                          | 20                                     |                      |  |  |
| -Class Test                           |                          | 15                                     |                      |  |  |
| -Presentation                         |                          | 5                                      |                      |  |  |
| -Total                                |                          | 100                                    |                      |  |  |
| 6. List of References                 |                          |  |                      |  |  |
| Plasticity: Fundamentals and General  | Results. , Editor: J. B. | Martin, ISBN-10: 026213114             | 5                    |  |  |
| Plasticity: Fundamentals and Applicat | ions, Editor: P.M. Dixi  | t, U.S. Dixit, ISBN 9781466506         | 5183                 |  |  |
|                                       |                          |  |                      |  |  |
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|                                       |                          |  |                      |  |  |
|                                       |                          |  |                      |  |  |
| 7. Facilities Requueired for Teaching | g and Learning           |  |                      |  |  |
| Computer lab                          |                          |  |                      |  |  |
| Course Coordinator: Nader M.          | Abuelfoutouh             |  |                      |  |  |
| Head of Department: Ayman H           | Kassem                   |  |                      |  |  |