



# MODULE HANDBOOK

## MEDICAL IMAGE PROCESSING



**BACHELOR DEGREE PROGRAM  
DEPARTMENT OF BIOMEDICAL ENGINEERING  
FACULTY OF INTELLIGENT ELECTRICAL AND INFORMATICS  
TECHNOLOGY**

**INSTITUT TEKNOLOGI SEPULUH NOPEMBER**



# MODULE HANDBOOK


## MEDICAL IMAGE PROCESSING

|   |   |   |
|---|---|---|
| Module name   | <b>Medical image processing</b>   |   |
| Module level  | Undergraduate   |   |
| Code  | EB184908  |   |
| Course (if applicable)                                | Medical Image processing  |   |
| Semester  | Specialization  |   |
| Person responsible for the module                     |   |   |
| Lecturer  | Nada Fitriyatul Hikmah, S.T., M.T.<br>Atar Fuady Babgei, S.T., M.Sc.  |   |
| Language  | Bahasa Indonesia and English  |   |
| Relation to curriculum                                | Undergraduate degree program, <b>Specialization</b>   |   |
| Type of teaching, contact hours                       | Lectures, <60 students  |   |
| Workload  | 1. Lectures : 3 x 50 = 150 minutes per week.<br>2. Exercises and Assignments : 3 x 50 = 150 minutes per week.<br>3. Private learning : 3 x 50 = 150 minutes per week.   |   |
| Credit points   | 3 credit points (sks)   |   |
| Requirements according to the examination regulations | A student must have attended at least 75% of the lectures to sit in the exams.  |   |
| Mandatory prerequisites                               | -   |   |
| Learning outcomes and their corresponding PLOs        | <p>Course Learning Outcome (CLO) after completing this module,</p> <p>CLO 1: Students understand the reasons for the need for image processing for medical images in terms of engineering and medicine.</p> <p>CLO 2: Students understand algorithms commonly used for medical image processing.</p> <p>CLO 3: Students are able to indentify problem or limitation form acquired medical image.</p> <p>CLO 4: Students are able to apply image processing algorithm in accordance with the problems in the medical image obtained.</p> | <p>PLO-02</p> <p>PLO-02</p> <p>PLO-05</p> <p>PLO-06</p> |

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| Content   | This course studies image processing algorithm commonly used for medical image.  |  |
| Study and examination requirements and forms of examination | <ul style="list-style-type: none"> <li>● In-class exercises</li> <li>● Written Assignment 1</li> <li>● Program assignment 1,2,3,4</li> <li>● Mid-term examination</li> <li>● Final examination</li> <li>● Final project</li> </ul> |  |
| Media employed  | LCD, whiteboard, websites (myITS Classroom), zoom.   |  |
| Reading list  | Main : <ol style="list-style-type: none"> <li>1. Q. Biekdwllnwe, "Applied Medical Image Processing," Francis &amp; Taylor.</li> </ol>  |  |



**I. Rencana Pembelajaran Semester / Semester Learning Plan**

|  |  | <b>INSTITUT TEKNOLOGI SEPULUH NOPEMBER (ITS)</b><br><b>FACULTY OF INTELLIGENT ELECTRICAL AND INFORMATICS TECHNOLOGY</b><br><b>DEPARTMENT OF BIOMEDICAL ENGINEERING</b>   |   |     |   | <b>Document Code</b>                             |
|---|--|--|---|-----|---|--|
| <b>SEMESTER LEARNING PLAN</b>   |  |  |   |     |   |  |
| <b>MATA KULIAH (MK)</b><br><b>COURSE</b>  | <b>KODE</b><br><b>CODE</b>   | <b>Rumpun MK</b><br><b>Course Cluster</b>  | <b>BOBOT (sks)</b><br><b>Credits</b>                        |     | <b>SEMESTER</b>                                   | <b>Tgl Penyusunan</b><br><b>Compilation Date</b> |
| <b>Pengolahan citra medika</b><br><i>Medical image processing</i>                 | EB184908   | <b>Teknik Biomedik</b><br><i>Biomedical engineering</i>  | T=3   | P=0 | <b>Peminatan</b><br><i>Specialization</i>         | Feb 27, 2020                                     |
| <b>OTORISASI / PENGESAHAN</b><br><b>AUTHORIZATION / ENDORSEMENT</b>               | <b>Dosen Pengembang RPS</b><br><i>Developer Lecturer of Semester Learning Plan</i>   |  | <b>Koordinator RMK</b><br><b>Course Cluster Coordinator</b> |     | <b>Ka DEPARTEMEN</b><br><b>Head of Department</b> |  |
|   | <b>(Nada Fitriyatul Hikmah, S.T, M.T)</b>  |  | <b>(M. Hilman Fatoni, S.T., M.T.)</b>                       |     | <b>(Dr. Achmad Arifin, S.T., M.Eng.)</b>          |  |
| <b>Capaian Pembelajaran</b>   | <b>CPL-PRODI yang dibebankan pada MK</b><br><b>PLO Program Charged to The Course</b> |  |   |     |   |  |
| <b>Learning Outcomes</b>  | <b>CPL-02</b><br><br><b>PLO-02</b>   | Mampu <b>menemukan, memahami, menjelaskan, merumuskan</b> , dan <b>menyelesaikan</b> permasalahan umum pada bidang Teknik dan permasalahan khusus pada bidang Teknik Biomedika yang meliputi instrumentasi biomedika cerdas, teknik rehabilitasi medika, pencitraan dan pengolahan citra medika, serta informatika medika<br><i>Able to find, understand, explain, formulate, and solve general problems in the field of Engineering and special problems in the field of Biomedical Engineering which includes intelligent biomedical instrumentation, medical rehabilitation techniques, imaging and processing of medical images, and medical informatics</i> |   |     |   |  |
|   | <b>CPL-05</b><br><br><b>PLO-05</b>   | Mampu <b>mendesain</b> komponen, sistem, dan proses dalam bidang Teknik Biomedika yang sistematis, logis, dan realistis sesuai dengan spesifikasi yang ditentukan dengan mempertimbangkan aspek keselamatan, sosial, budaya, lingkungan, dan ekonomi dengan <b>mengenal/memanfaatkan</b> sumber daya lokal dan nasional dengan wawasan global  |   |     |   |  |

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|--|--|--|
|  |  | <i>Able to design components, systems, and processes in the field of Biomedical Engineering that are systematic, logical, and realistic appropriate with specified specifications by considering aspects of safety, social, cultural, environmental, and economic by recognizing / utilizing local and national resources with global insight.</i> |
| CPL-06   |  | Mampu <b>menerapkan</b> ilmu pengetahuan, keterampilan, dan metode terkini dalam menyelesaikan permasalahan di bidang Teknik Biomedika   |
| PLO-06   |  | <i>Able to apply the latest knowledge, skills and methods in solving problems in the field of Biomedical Engineering</i>   |
| <b>Capaian Pembelajaran Mata Kuliah (CPMK)</b><br><b>Course Learning Outcome (CLO) - If CLO as description capability of each Learning Stage in the course, then CLO = LLO</b> |  |  |
| <b>CP MK 1</b><br><b>CLO 1</b>   |  | Mahasiswa memahami alasan kebutuhan pengolahan citra untuk citra medika dari segi teknik maupun kedokteran.<br>Students understand the reasons for the need for image processing for medical images in terms of engineering and medicine.  |
| <b>CP MK 2</b><br><b>CLO 2</b>   |  | Mahasiswa memahami algoritma-algoritma yang umum digunakan untuk pengolahan citra medika<br>Students understand algorithms commonly used for medical image processing.   |
| <b>CP MK 3</b><br><b>CLO 3</b>   |  | Mahasiswa mampu mengidentifikasi permasalahan atau limitasi dari citra medika yang diperoleh.<br>Students are able to indentify problem or limitation form acquired medical image.   |
| <b>CP MK 4</b><br><b>CLO 4</b>   |  | Mahasiswa mampu mengaplikasikan algoritma pengolahan citra yang sesuai dengan permasalahan pada citra medika yang diperoleh.<br>Students are able to apply image processing algorithm in accordance with the problems in the medical image obtained.   |

| Peta CPL – CP MK  |   |        |        |        |        |        |        |        |        |        |        |        |
|---|---|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| <i>Map of PLO - CLO</i>   | CPL-01  | CPL-02 | CPL-03 | CPL-04 | CPL-05 | CPL-06 | CPL-07 | CPL-08 | CPL-09 | CPL-10 | CPL-11 | CPL-12 |
| CPMK 1 / SUB CPMK 1<br><i>CLO 1 / LLO 1</i>                                 |   | ✓      |        |        |        |        |        |        |        |        |        |        |
| CPMK 2 / SUB CPMK 2<br><i>CLO 2 / LLO 2</i>                                 |   | ✓      |        |        |        |        |        |        |        |        |        |        |
| CPMK 3 / SUB CPMK 3<br><i>CLO 3 / LLO 3</i>                                 |   |        |        |        | ✓      |        |        |        |        |        |        |        |
| CPMK 4 / SUB CPMK 4<br><i>CLO 4 / LLO 4</i>                                 |   |        |        |        |        | ✓      |        |        |        |        |        |        |
| <b>Diskripsi Singkat MK</b>   | Mata kuliah ini mempelajari tentang algoritma pengolahan citra yang sering digunakan untuk citra medika.  |        |        |        |        |        |        |        |        |        |        |        |
| <b>Short Description of Course</b>  | <i>This course studies image processing algorithm commonly used for medical image.</i>  |        |        |        |        |        |        |        |        |        |        |        |
| <b>Bahan Kajian:</b><br>Materi pembelajaran<br><br><b>Course Materials:</b> | <ol style="list-style-type: none"> <li>1. Teknik pencitraan biomedika/biomedical imaging technique</li> <li>2. Dasar pengolahan sinyal dan citra/ <i>Basic signal and image processing</i></li> <li>3. Image filtering</li> <li>4. Deformable model</li> <li>5. Image Segmentation</li> <li>6. Image Enhancement</li> <li>7. Image Registration</li> <li>8. Image Reconstruction</li> <li>9. Image Visualization</li> </ol> |        |        |        |        |        |        |        |        |        |        |        |
| <b>Pustaka</b>  | <b>Utama / Main:</b>  |        |        |        |        |        |        |        |        |        |        |        |

| <b>References</b>                         |  | 1. Q. Biekdwllnwe, "Applied Medical Image Processing," Francis & Taylor. |   |   |                     |  |                                      |
|---|--|--|---|---|---------------------|--|--------------------------------------|
|   |  | <b>Pendukung / Supporting:</b>   |   |   |                     |  |                                      |
| <b>Dosen Pengampu<br/>Lecturers</b>       |  |  |   |   |                     |  |                                      |
| <b>Matakuliah syarat<br/>Prerequisite</b> |  | -  |   |   |                     |  |                                      |
| Mg ke/<br>Week                            | Kemampuan akhir tiap tahapan belajar (Sub-CPMK)<br>/<br>Final ability of each learning stage (LLO) | Penilaian / Assessment   |   | Bentuk Pembelajaran; Metode Pembelajaran; Penugasan Mahasiswa;<br>[ Estimasi Waktu] /<br>Form of Learning; Learning Method;<br>Student Assignment;<br>[ Estimated Time] |                     | Materi Pembelajaran<br>[Pustaka] /<br>Learning Material<br>[Reference] | Bobot Penilaian /Assessment Load (%) |
|   |  | Indikator / Indicator  | Kriteria & Teknik / Criteria & Techniques | Tatap Muka / In-class (5)   | Daring / Online (6) |  |                                      |
| (1)                                       | (2)  | (3)  | (4)                                       | (5)   | (6)                 | (7)  | (8)                                  |



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|-------------------|---|--|--|--|---|--|-----------------|
| <p><b>1,2</b></p> | <p>Mahasiswa memahami alasan kebutuhan pengolahan citra untuk citra medika dari segi teknik maupun kedokteran.</p> <p>Students understand the reasons for the need for image processing for medical images in terms of engineering and medical.</p> | <ul style="list-style-type: none"> <li>• Mampu menjelaskan limitasi dari teknik pencitraan medika yang tersedia dan teknik-teknik yang dapat diaplikasikan guna mengatasi limitasi tersebut secara umum</li> <li>• <i>Able to explain the limitation of the available medical image techniques and techniques that can be applied to overcome these limitations in general.</i></li> </ul> | <p><b>Non-tes :</b><br/> <b>Tugas 1 tahap 1:</b><br/> Menjelaskan konsep modalitas yang diperlukan pada pencitraan medika.</p> <p><b>Non-test :</b><br/> <b>Task 1 stage 1:</b><br/> <i>Explain modality concept required in medical imaging</i></p> | <ul style="list-style-type: none"> <li>• Kuliah dan brainstorming, tanya jawab.<br/> [TM : 3 x 50"]<br/> [BM : 3 x 60"]<br/> [PT : 3 x 50"]</li> <li>• <i>Lecturing and discussion, ask and answer.</i><br/> [FF : 1 x 50"]<br/> [SA : 1 x 60"]<br/> [SS : 1 x 60"]</li> </ul> | <ul style="list-style-type: none"> <li>• Chatting dan diskusi dalam forum platform ITS.</li> <li>• <i>Chat and discussion in ITS platform forum.</i></li> </ul> | <ul style="list-style-type: none"> <li>• <i>Konsep modalitas</i></li> <li>• <i>Pengolahan citra dan medika</i></li> <li>• <i>Modality concept</i></li> <li>• <i>Image and signal processing</i></li> </ul> | <p><b>4</b></p> |
| <p><b>3,4</b></p> | <p>Mahasiswa mehamami proses penyaringan hasil citra medika untuk mendapatkan fokus citra yang diinginkan</p> <p><i>Students are able to understand the process of filtering the results of medical</i></p>   | <ul style="list-style-type: none"> <li>• Mampu menggunakan teknik-teknik image filtering dan deformable model untuk menyaring area pada citra yang tidak diperlukan</li> <li>• <i>Able to use image filtering technique and</i></li> </ul>   | <p><b>Non-tes :</b><br/> <b>Tugas 1 pemrograman:</b><br/> Membuat program yang dapat:</p> <ul style="list-style-type: none"> <li>• Mengidentifikasi area pada citra medika yang mengganggu proses</li> </ul>   | <ul style="list-style-type: none"> <li>• Kuliah dan brainstorming, tanya jawab.<br/> [TM : 3 x 50"]<br/> [BM : 3 x 60"]<br/> [PT : 3 x 50"]</li> <li>• <i>Lecturing and brainstorming, ask and answer.</i><br/> [FF : 1 x 50"]</li> </ul>                                      |   | <ul style="list-style-type: none"> <li>• Image filtering</li> <li>• Deformable model</li> </ul>  | <p><b>4</b></p> |

|      |   |   |  |  |  |   |           |
|------|---|---|--|--|--|---|-----------|
|      | <i>images to get the desired image focus</i>  | <i>model deformable to filter unnecessary area of the image</i>   | <p>pengolahan citra</p> <ul style="list-style-type: none"> <li>Menyaring dan menampilkan fokus area citra medika yang diinginkan</li> </ul> <p><b>Non-test :</b><br/> <b>Task 1</b><br/> <b>programming:</b><br/> <i>Make program that can :</i></p> <ul style="list-style-type: none"> <li><i>identify area in medical image that interfere image processing process</i></li> <li><i>filtering and displaying focus area medical image</i></li> </ul> | <p>[SA : 1 x 60"]<br/> [SS : 1 x 60"]</p>  |  |   |           |
| 5- 7 | Mahasiswa memahami teknik pengolahan citra untuk menghasilkan citra dengan kualitas dan fokus yang lebih baik | <ul style="list-style-type: none"> <li>Mempu mengaplikasikan teknik Image Segmentation dan Enhancement untuk mendapatkan citra</li> </ul> | <p><b>Non-tes :</b><br/> Tugas Pemrograman 2</p> <p>Mengubah kualitas dan fokus dari hasil penyaringan citra</p>   | <ul style="list-style-type: none"> <li>Kuliah dan brainstorming, tanya jawab.<br/> [TM : 3 x 50"]<br/> [BM : 3 x 60"]<br/> [PT : 3 x 50"]</li> </ul> |  | <ul style="list-style-type: none"> <li><i>Image Segmentation</i></li> <li><i>Image Enhancement</i></li> </ul> | <b>12</b> |

|               |   |   |   |   |  |   |           |
|---------------|---|---|---|---|--|---|-----------|
|               | <i>Students understand image processing technique to produce image with more quality and focus</i>  | <p>dengan kualitas yang lebih bagus</p> <ul style="list-style-type: none"> <li>• <i>Able to apply image segmentation and enhancement technique to obtain a higher quality image</i></li> </ul>  | <p>sesuai dengan ketentuan.</p> <p><b>Non-test :</b><br/> <b>Task 1 stage 2:</b><br/> <i>Change the quality and focus of the filtered image according to the condition</i></p>  | <ul style="list-style-type: none"> <li>• <i>Lecturing and brainstorming, ask and answer.</i><br/> [FF : 3 x 50"]<br/> [SA : 3 x 60"]<br/> [SS : 3 x 50"]</li> </ul>   |  |   |           |
| <b>8</b>      | <b>EVALUASI TENGAH SEMESTER<br/>MID-SEMESTER EXAM</b>   |   |   |   |  |   | <b>30</b> |
| <b>9 - 10</b> | <p>Mahasiswa memahami teknik pengolahan citra untuk mendapatkan informasi yang diinginkan dari citra medika</p> <p><i>Students are able to understand image processing technique to obtain desired information from medical image</i></p> | <ul style="list-style-type: none"> <li>• Mampu menerapkan teknik image registration untuk mendapatkan informasi yang diinginkan dari citra medika dengan data yang diperoleh.</li> <li>• <i>Able to apply image registration technique to obtain desired information from medical image with data acquired</i></li> </ul> | <p><b>Non-tes :</b></p> <p><b>Tugas Pemrograman 3</b></p> <p>Membuat program untuk mendapatkan informasi yang telah ditentukan dengan teknik image registration</p> <p><b>Non-test :</b></p> <p><b>Task 3:</b><br/> <i>Made program to obtain information that has been determined by</i></p> | <ul style="list-style-type: none"> <li>• Kuliah dan brainstorming, tanya jawab dan praktikum.<br/> [TM : 3 x 50"]<br/> [BM : 3 x 60"]<br/> [PT : 3 x 50"]<br/> [PK : 1x 50"]</li> <li>• <i>Lecturing and brainstorming, ask and answer.</i><br/> [FF : 3 x 50"]<br/> [SA : 3 x 60"]<br/> [SS : 3 x 50"]<br/> [PC : 1x 50"]</li> </ul> |  | <ul style="list-style-type: none"> <li>• <i>Image registration</i></li> </ul> | <b>5</b>  |

|               |   |   |   |   |  |   |          |
|---------------|---|---|---|---|--|---|----------|
|               |   |   | <i>image registration technique</i>   |   |  |   |          |
| <b>11 -13</b> | <p>Mahasiswa memahami teknik pengolahan citra untuk merekonstruksi ulang citra yang telah di olah</p> <p><i>Students understand image processing techniques to reconstruct the image that has been processed.</i></p> | <ul style="list-style-type: none"> <li>• Mampu merekonstruksi ulang citra medika yang telah dioleh berdasarkan jenis citra dan informasi yang ingin di dapat dari citra tersebut</li> <li>• <i>able to reconstruct medical image that has been processed based on the type of image and information you want to get from the image</i></li> </ul> | <p><b>Non tes:</b><br/><b>Tugas Pemrograman 4</b></p> <p>Merekonstruksi ulang citra yang telah diolah dengan melakukan overlay terhadap citra asli</p> <p>Merekonstruksi ulang citra yang telah diolah dengan menggabungkan beberapa citra dua dimensi menjadi 1 citra tiga dimensi</p> <p><b>Non-test:</b><br/><b>Task 4:</b><br/>- <i>reconstruct image that has been processed</i></p> | <ul style="list-style-type: none"> <li>• Kuliah dan brainstorming, tanya jawab.<br/>[TM : 3 x 50"]<br/>[BM : 3 x 60"]<br/>[PT : 3 x 50"]</li> <li>• <i>Lecturing and brainstorming, ask and answer.</i><br/>[FF : 3 x 50"]<br/>[SA : 3 x 60"]<br/>[SS : 3 x 50"]</li> </ul> |  | <ul style="list-style-type: none"> <li>• <i>Image Reconstruction</i></li> <li>• <i>Image Visualization</i></li> </ul> | <b>5</b> |

|              |  |   |   |  |  |  |           |
|--------------|--|---|---|--|--|--|-----------|
|              |  |   | <p><i>by overlaying original image</i></p> <p>- <i>reconstruct the processed image by combining several two dimensional image to one dimensional image.</i></p>   |  |  |  |           |
| <b>14</b>    | <p>Mahasiswa mampu mengaplikasikan teknik pengolahan citra di bidang pencitraan medika</p> <p><i>Students are able to apply image processing technique in the field of medical imaging</i></p> | <p>Mampu menerapkan teknik pengolahan citra yang tepat sesuai dengan permasalahan pada hasil pencitraan medika</p> <p><i>Able to apply medical imaging technique according to the problems in medical imaging results</i></p> | <p><b>Final Project</b></p> <p>Mereplikasikan teknik pengolahan citra untuk pencitraan medika berdasarkan makalah jurnal atau konferen terkini yang tersedia</p> <p><i>Replicate image processing for medical imaging according to journal or available latest conference</i></p> | <ul style="list-style-type: none"> <li>• Kuliah dan brainstorming, tanya jawab.<br/>[TM : 3 x 50"]<br/>[BM : 3 x 60"]<br/>[PT : 3 x 50"]</li> <li>• Lecturing and brainstorming, ask and answer.<br/>[FF : 3 x 50"]<br/>[SA : 3 x 60"]<br/>[SS : 3 x 50"]</li> </ul> |  |  |           |
| <b>15-16</b> | <b>EVALUASI AKHIR SEMESTER</b>   |   |   |  |  |  | <b>40</b> |


|  |                            |  |
|--|----------------------------|--|
|  | <b>FINAL-SEMESTER EXAM</b> |  |
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**TM**=Tatap Muka, **PT**=Penugasan Terstruktur, **BM**=Belajar Mandiri,**PK**=praktikum.

**FF** = Face to Face, **SA** = Structured Assignment, **SS** = Self Study,**PC** = practicum.



## II. Rencana Asesmen & Evaluasi (RAE) / *Assessment & Evaluation Plan*

|   |   |   |  |
|---|---|---|--|
|  | <b>ASSESSMENT &amp; EVALUATION PLAN</b><br><b>BACHELOR DEGREE PROGRAM OF BIOMEDICAL ENGINEERING - FTEIC ITS</b><br><b>Course : Medical Image Processing</b> |   | <b>RA&amp;E</b>  |
|   |   |   | Write<br>Doc Code  |
| Kode/code:<br><b>EB184908</b>   | Bobot sks/credits (T/P): <b>3/0</b>   | Rumpun MK: <b>Ilmu Dasar Teknik</b><br>Course Cluster: <b>Basic Engineering</b>                       | Smt:<br>selection  |
| <b>OTORISASI AUTHORIZATION</b>  | Penyusun RA & E<br><i>Compiler A&amp;EP</i><br><br><b>Nada Fitriyatul H, S.T, M.T</b>   | Koordinator RMK<br><i>Course Cluster Coordinator</i><br><br><b>Muhammad Hilman Fatoni, S.T., M.T.</b> | Ka DEP<br><i>Head of DEP</i><br><br><b>Dr. Achmad Arifin, S.T., M.Eng.</b> |

| Mg ke/<br>Week<br>(1) | Sub CP-MK /<br><i>Lesson Learning Outcomes (LLO)</i><br>(2)  | Bentuk Asesmen (Penilaian)<br><i>Form of Assessment</i><br>(3)   | Bobot /<br>Load (%)<br>(4)                     |
|-----------------------|--|--|--|
| 1,2                   | <b>Sub CP-MK 1:</b><br>Mahasiswa memahami alasan kebutuhan pengolahan citra untuk citra medika dari segi teknik maupun kedokteran.<br><br><b>LLO 1:</b><br>Students understand the reasons for the need for image processing for medical images in terms of engineering and medical. | <b>Non-tes :</b><br><b>Tugas tertulis 1:</b><br>Menjelaskan konsep modalitas yang diperlukan pada pencitraan medika.<br><br><b>Tes:</b><br>ETS 1 soal (5%)<br><br><b>Non-test :</b><br><b>Written assignment 1:</b><br>Explain modality concept required in medical imaging<br><br><b>Test:</b><br>ETS 1 number(5%)                                  | Tugas tertulis<br>1/written assignment<br>: 5% |
| 3,4                   | <b>Sub CP-MK 2:</b><br>Mahasiswa memahami proses penyaringan hasil citra medika untuk mendapatkan fokus citra yang diinginkan<br><br><b>LLO 2:</b><br>Students are able to understand the process of filtering   | <b>Non-tes :</b><br><b>Tugas 1 pemrograman:</b><br>Membuat program yang dapat: <ul style="list-style-type: none"> <li>• Mengidentifikasi area pada citra medika yang mengganggu proses pengolahan citra</li> <li>• Menyaring dan menampilkan fokus area citra medika yang diinginkan</li> </ul><br><b>Tes:</b><br>ETS 1 soal (5%)<br>EAS 1 soal (5%) | Tugas demo<br>1/demo assignment<br>:10 %       |

|      |  |  |  |
|------|--|--|--|
|      | <p><i>the results of medical images to get the desired image focus</i></p>   | <p><b>Non-test :</b><br/> <b>Task 1 programming:</b><br/>         Make program that can :</p> <ul style="list-style-type: none"> <li>• <i>identify area in medical image that interfere image processing process</i></li> <li>• <i>filtering and displaying focus area medical image</i></li> </ul> <p><b>Test:</b><br/>         EAS 1 number (5%)<br/>         ETS 1 number(5%)</p>   |  |
| 5-7  | <p><b>Sub CP-MK 3:</b><br/>         Mahasiswa memahami teknik pengolahan citra untuk menghasilkan citra dengan kualitas dan fokus yang lebih baik</p> <p><b>LLO 3:</b><br/> <i>Students understand image processing technique to produce image with more quality and focus</i></p> | <p><b>Non-tes :</b><br/> <b>Tugas Pemrograman 2:</b><br/>         Mengubah kualitas dan fokus dari hasil penyaringan citra sesuai dengan ketentuan.</p> <p><b>Tes:</b><br/>         ETS 1 soal (5%)<br/>         EAS 1 soal (5%)</p> <p><b>Non-test :</b><br/> <b>Programming assignment:</b><br/> <i>Change the quality and focus of the filtered image according to the condition</i></p> <p><b>Test:</b><br/>         EAS 1 number (5%)<br/>         ETS 1 number(5%)</p> | <p>Tugas demo 2/Demo assignment :10%</p> |
| 8    | <p><b>Evaluasi Tengah Semester</b></p> <p><b>Mid Exam</b></p>  | <p><b>Tes:</b><br/>         Ujian Tulis/Ujian Daring</p> <p><b>Test:</b><br/>         Writing Exams / Online Exams</p>   | <p>15%</p>                               |
| 9-10 | <p><b>Sub CP-MK 4:</b><br/>         Mahasiswa memahami teknik pengolahan citra untuk mendapatkan informasi yang diinginkan dari citra medika</p> <p><b>LLO 4:</b><br/> <i>Students are able to understand image processing technique to obtain desired</i></p>                     | <p><b>Non-tes :</b><br/> <b>Tugas Pemrograman 3</b><br/>         Membuat program untuk mendapatkan informasi yang telah ditentukan dengan teknik image registration</p> <p><b>Tes:</b><br/>         EAS 1 soal (5%)</p> <p><b>Non-test :</b><br/> <b>Programming assignment 3:</b><br/> <i>Made program to obtain information that has been determined by image registration technique</i></p>   | <p>Tugas demo/dem o assignment : 10%</p> |

|  |   |   |                                    |
|--|---|---|------------------------------------|
|  | <i>information from medical image</i>   | <b>Test:</b><br><i>EAS 1 number (5%)</i>  |                                    |
| <b>11-13</b>   | <p><b>Sub CP-MK 5:</b><br/>Mahasiswa memahami teknik pengolahan citra untuk merekonstruksi ulang citra yang telah di olah</p> <p><b>LLO 5:</b><br/><i>Students understand image processing techniques to reconstruct the image that has been processed.</i></p> | <p><b>Non tes:</b><br/><b>Tugas Pemrograman 4</b><br/>Merekonstruksi ulang citra yang telah diolah dengan melakukan overlay terhadap citra asli<br/>Merekonstruksi ulang citra yang telah diolah dengan menggabungkan beberapa citra dua dimensi menjadi 1 citra tiga dimensi</p> <p><b>Tes:</b><br/><i>EAS 1 soal (5%)</i></p> <p><b>Non-test:</b><br/><b>Programming Assignment 4:</b><br/>- <i>reconstruct image that has been processed by overlaying original image</i><br/>- <i>reconstruct the processed image by combining several two dimensional image to one dimensional image.</i></p> <p><b>Test:</b><br/><i>EAS 1 number (5%)</i></p> | Tugas Demo 4/Demo assignment 4:10% |
| <b>14</b>  | <p><b>Sub CP-MK 6:</b><br/>Mahasiswa mampu mengaplikasikan teknik pengolahan citra di bidang pencitraan medika</p> <p><b>LLO 6:</b><br/><i>Students are able to apply image processing technique in the field of medical imaging</i></p>                        | <p><b>Final Project</b><br/>Mereplikasikan teknik pengolahan citra untuk pencitraan medika berdasarkan makalah jurnal atau konferen terkini yang tersedia</p> <p><i>Replicate image processing for medical imaging according to journal or available latest conference</i></p>  | Final project :20%                 |
| <b>16</b>  | <p><b>Evaluasi Akhir</b></p> <p><b>Final Exam</b></p>   | <p><b>Tes:</b><br/>Ujian Tulis/Ujian Daring</p> <p><b>Test:</b><br/><i>Writing Exams / Online Exams</i></p>   | 20%                                |
| <b>Total bobot penilaian<br/>Total assessment load</b> |   |   | <b>100%</b>                        |

● **Indikator Pencapaian CPL Pada MK / *Indicator of PLO achievement charged to the course***

| CPL yang dibebankan pada MK / <i>PLO charged to the course</i> | CPMK / <i>Course Learning Outcome (CLO)</i> | Minggu ke / <i>Week</i> | Bentuk Asesmen / <i>Form of Assessment</i> | Bobot / <i>Load (%)</i> |
|--|---|-------------------------|--|-------------------------|
| CPL-02 / <i>PLO-02</i>   | CPMK 1 / <i>CLO 1</i>                       | Week- 1-2               | Task 1 written test                        | 5                       |
|  |   | Week- 8                 | Mid Exam Question 1                        | 5                       |
| CPL-03 / <i>PLO-03</i>   | CPMK 2 / <i>CLO 2</i>                       | Week- 3-4               | Task 1 programming                         | 10                      |
|  |   | Week- 8                 | Mid Exam Question 2                        | 5                       |
|  |   | Week- 16                | Final Exam Question 1                      | 5                       |
|  |   | Week- 5-7               | Task 2 programming                         | 10                      |
| CPL-04 / <i>PLO-04</i>   | CPMK 3 / <i>CLO 3</i>                       | Week-8                  | Mid exam question 3                        | 5                       |
|  |   | Week- 16                | Final Exam Question 2                      | 5                       |
|  |   | Week- 9-10              | Task 3 programming                         | 10                      |
| CPL-05 / <i>PLO-05</i>   | CPMK 4 / <i>CLO 4</i>                       | Week- 16                | Final Exam Question 3                      | 5                       |
|  |   | Week- 11-13             | Task 4 programming                         | 10                      |
| CPL-06 / <i>PLO-06</i>   | CPMK 5 / <i>CLO 5</i>                       | Week- 16                | Final Exam Question 4                      | 5                       |
|  |   | Week 14                 | Final project                              | 20                      |
|  |   |                         |  | <b>∑ = 100%</b>         |

| No | Form of Assessment | PLO-01 | PLO-02 | PLO-03 | PLO-04 | PLO-05 | PLO-06 | PLO-07 | PLO-08 | PLO-09 | PLO-10 | PLO-11 | PLO-12 | Total |
|----|--------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
| 1  | Task 1 written     |        | 0.05   |        |        |        |        |        |        |        |        |        |        | 0.05  |
| 2  | Task 1             |        | 0.1    |        |        |        |        |        |        |        |        |        |        | 0,1   |
| 3  | Task 2             |        | 0.1    |        |        |        |        |        |        |        |        |        |        | 0,1   |
| 4  | Task 3             |        |        |        |        | 0.1    |        |        |        |        |        |        |        | 0,1   |
| 5  | Task 4             |        |        |        |        |        | 0.1    |        |        |        |        |        |        | 0,1   |
| 6  | Mid Exam           |        | 0.15   |        |        |        |        |        |        |        |        |        |        | 0.15  |

|   |                      |  |     |  |  |      |      |  |  |  |  |  |  |            |
|---|----------------------|--|-----|--|--|------|------|--|--|--|--|--|--|------------|
| 7 | <i>Final Exam</i>    |  | 0.1 |  |  | 0.05 | 0.05 |  |  |  |  |  |  | <b>0,2</b> |
| 8 | <i>Final project</i> |  |     |  |  |      | 0.2  |  |  |  |  |  |  | <b>0,2</b> |
|   | <i>Total</i>         |  | 0,5 |  |  | 0,15 | 0,35 |  |  |  |  |  |  | <b>1</b>   |