***Lesson Plan***

***Academic year: 2021-22 Faculty :Binsy Joseph***

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CLASS** | | | | | | **BE Electronics, Semester VII** | | | | | |  |
| **Academic Term** | | | | | | **July-December 2021** | | | | | |  |
| **Subject** | | | | | | **Power Electronics (ELX702)** | | | | | |  |
| ***Periods (Hours) per week*** | | | | ***Lecture*** | | | ***4*** | | | | |  |
| ***Practical*** | | | ***2*** | | | | |  |
| ***Tutorial*** | | | ***--*** | | | | |  |
| ***Evaluation System*** | | | |  | | | ***Hours*** | ***Marks*** | | | |  |
| Theory examination | | | 3 | 80 | | | |  |
| Internal Assessment | | | -- | 20 | | | |  |
| Practical Examination | | | -- | 25 | | | |  |
| Oral Examination | | | -- | -- | | | |  |
| Term work | | | -- | 25 | | | |  |
| Total | | | -- | 100 | | | |  |
|  | | | | | | | | | | | |  |
| ***Time Table*** | | | | ***Day*** | | | ***Time*** | | | | |  |
| Monday | | | 11.20 am to 12.20 | | | | |  |
| Wednesday | | | 11.20 am to 12.20 | | | | |  |
| Thursday | | | 10.10 am to 11.10 am | | | | |  |
| Friday | | | 9.00 am to 10.00 am | | | | |  |
| ***Course Content and Lesson plan*** | | | | | | | | | | | |  |
| **Week** | **No.** | **Date** | | | **Topic** | | | | **References** | **Mapped** | | **Remark** |
| **Planned** | **Actual** | |  | | | |  | **CO** | **PO** |  |
| ***Module 1: Power semiconductor devices*** | | | | | | | | | | | |  |
| 1 | 1 | 13-07-2021 | 13-07-2021 | | Introduction to Power Electronics and Converter Applications | | | | Ref. 1,2,4 | CO1 | PO1 | PPT, |
| 2 | 15-07-2021 | 15-07-2021 | | Overview of switching devices ,Power Diode ,construction and characteristics. | | | | Ref. 1,2,4 | CO1 | PO1 | Quiz |
| 3 | 16-07-2021 | 16-07-2021 | | SCR structure, construction and V-I characteristics | | | | Ref.2 | CO1 | PO1 |  |
| 2 | 4  5  6 | 20-07-2021 | 20-07-2021 | | SCR Ratings | | | | Ref. 2,4 | CO1 | PO1 | Placement ,canceled lecture |
| 22-07-2021 | 22-07-2021 | | 2 Transistor Model of SCR | | | |  |  |  |  |
| 23-07-2021 | 23-07-2021 | | SCR-Switching characteristics (Turn On &OFF ),Gate characteristics | | | |  |  |  | Assignment 1 |
| 3 | 7 | 27-07-2021 | 27-07-2021 | | SCR Turn ON Methods | | | | Ref. 2,4 | CO1 | PO1 |  |
| 8 | 28-07-2021 | 28-07-2021 | | TRIAC and DIAC working ,Application and characteristics | | | |  |  |  | Quiz |
| 9 | 29-07-2021 | 29-07-2021 | | Selection of power devices and POWER BJT | | | | Ref. 1, 4 | CO1 | PO1 |  |
| 10 | 30-07-2021 | 30-07-2021 | | POWER MOSFET-CHARACTERISTICS AND WORKING  IGBT: working principle, characteristics, SOA | | | | Ref. 2,4 | CO1 | PO1 |  |
| ***Module 2: SCR Triggering, commutation and Protection Circuits*** | | | | | | | | | | | |
| 11 | 02-08-2021 | 02-08-2021 | | Triggering methods of SCR,  Gate triggering: R | | | | Ref.2 | CO1 | PO1 |  |
| 4 | 12 | 04-08-2021 | 04-08-2021 | | RC triggering,waveform analysis | | | | Ref.2 | CO1 | PO1 | Assignment 2 |
| 13 | 05-08-2021 | 05-08-2021 | | UJT construction and UJT characteristic | | | |  |  |  |  |
| 14 | 06-08-2021 | 06-08-2021 | | UJT triggering ckt. Operation | | | |  |  |  | Quiz |
| 5 | 15 | 09-08-2021 | 09-08-2021 | | Ramp and Pedestal ,Cosine Inverse triggering | | | | Ref.2 | CO1 | PO1 |  |
| 16 | 11-08-2021 | 11-08-2021 | | SCR Turn OFF,Commutation circuits: Class A | | | | Ref.2 | CO1 | PO1, PO3 |  |
| 17 | 12-08-2021 | 12-08-2021 | | Commutation circuits: Class B | | | | Ref.2 | CO1 | PO1, PO3 | Quiz |
| 18 | 13-08-2021 | 13-08-2021 | | Commutation circuits: Class C | | | |  |  |  |  |
| 6 |  |  |  | | **UT1-Aug 17th-20th,21** | | | |  |  |  |  |
| 7 | 19 | 23-08-2021 |  | | Commutation circuits: Class D,E, F | | | | Ref.1,2,3 | CO1 | PO1  PO2 |  |
| ***Module 3: Single Phase Controlled Rectifiers*** | | | | | | | | | | |  |
| 20  21  22 | 25-08-2021 |  | | Half wave controlled rectifier with R and R-L load, effect of free-wheeling diode | | | | Ref. 1,2,3,4 | CO2 | PO1, PO2 |  |
| 26-08-2021 |  | | Full wave half controlled rectifier with R, R-L load, effect of free-wheeling diode | | | |  |  |  |  |
| 27-08-2021 |  | | Effect of Source inductance, Numericals | | | |  |  |  |  |
| 8 | 23 | 30-08-2021 |  | | Full wave fully controlled rectifier with R, R-L, effect of free- wheeling diode | | | | Ref. 1,2,3,4 | CO2 | PO1, PO2 | Assignment3 |
| 24 | 01-09-2021 |  | | Definitions and significance of input and output performance parameters, Derivations | | | | Ref. 1,2,3,4 | CO2 | PO1, PO2 |  |
| 25 | 02-09-2021 |  | | Numerical examples on performance parameters,Quiz | | | | Ref. 1,2 | CO2 | PO1, PO2 | Quiz |
| 26 | 03-09-2021 |  | | Basics of Choppers,classifications | | | | Ref. 1,2 | CO2 | PO1, PO2 |  |
| ***Module 4: Inverters*** | | | | | | | | | | |  |
| 27 | 06-09-2021 |  | | Inverter basics and applications, Series Inverter | | | | Ref. 1,2,3,4 | CO2 | PO1 | Assignment4 |
| 28 | 08-09-2021 |  | | Parallel inverters | | | | Ref. 1,2,3,4 | CO2 | PO1 |  |
| 29 | 09-09-2021 |  | | Principle of operation of Half Bridge Inverter: R and R-L load | | | | Ref. 1,2,3,4 | CO2 | PO1 |  |
| 10 | 30 | 13-09-2021 |  | | Principle of operation of Full Bridge Inverter: R and R-L load | | | | Ref. 1,2,3,4 | CO2 | PO1 |  |
| 31 | 15-09-2021 |  | | Performance parameters of Inverter: quiz, Numerical problems on inverters: doubt solving | | | | Ref. 1,2,3,4 | CO2 | PO1, PO2 |  |
| 32 | 16-09-2021 |  | | Voltage control using PWM technique | | | | Ref. 1,2,3,4 | CO2 | PO1 | Quiz |
| 33 | 17-09-2021 |  | | PWM techniques for inverters | | | | Ref. 1,2,3,4 | CO2 | PO1 |  |
| 11 | 34 | 20-09-2021 |  | | Harmonics, effect of harmonics, Harmonic Neutralization | | | | Ref. 1,2,3,4 | CO2 | PO1, |  |
| 35 | 22-09-2021 |  | | Numerical problems , Quiz | | | | Ref. 2,3,4 | CO2 | PO1 |  |
| **Module 5 Chopper** | | | | | | | | | | | |
| 36 | 23-09-2021 |  | | Step down chopper with RL load | | | | Ref. 2,3,4 | CO2 | PO1 |  |
| 37 | 24-09-2021 |  | | step up chopper principle, numerical example, | | | | Ref. 2,3,4 | CO2 | PO1 | Assignment5 |
|  |  | | | | | | | | | | | |
| 12 | 38 | 27-09-2021 |  | | time-ratio control, Current limit control strategy, | | | | Ref. 2,3,4 | CO2 | PO1 |  |
| 39 | 29-09-2021 |  | | Buck Boost Converter, | | | | Ref. 2,3,4 | CO2 | PO1 |  |
| 40 | 30-09-2021 |  | | Cuk Converter | | | | Ref. 2,3,4 | CO2 | PO1 |  |
| 41 | 01-10-2021 |  | | Voltage commutated converters | | | | Ref. 2,3,4 | CO2 | PO1 | Quiz |
| 13 | 42 | 04-10-2021 |  | | Current commutated converters | | | | Ref. 2,3,4 | CO2 | PO1 |  |
| 43 | 06-10-2021 |  | | Load commutated Converters | | | | Ref. 2,3,4 | CO2 | PO1 | Presentation |
| 44 | 07-10-2021 |  | | Applications in SMPS, Battery charging systems | | | | Ref. 2 | CO2 | PO1 | IEEE Paper Reading |
|  |  |  | |  | | | |  |  |  |  |
|  | ***Module 6: A.C.Voltage Controller and Cyclo-converters*** | | | | | | | | | | | |
| 14 | 45 | 08-10-2021 |  | | Principle of On-Off, Principle of phase control | | | | Ref. 2,4 | CO4 | PO1 |  |
| 46 | 14-10-2021 |  | | Single phase bidirectional control of R load and R-L load, | | | | Ref. 2,4 | CO4 | PO1 |  |
| 47 | 15-10-2021 |  | | 1 phase and 3 phase Cyclo-converter and applications | | | | Ref. 2 | CO4 | PO1 | Flipped classroom |
| 48 |  | --- | | Students’ presentations on Power Electronics applications | | | |  | CO2 | PO1, PO2 | Students Presentations |
|  | **Unit Test 2 11th-13th Oct,2021** | | | | | | | | | | | |
| Total Number of lectures | | | 48 | |  | | | |  |  |  |  |

**Reference Books:**

|  |  |  |
| --- | --- | --- |
| **Sr. No.** | **Authors, Title and Publisher of the book** | **Number of copies available in library** |
| 1 | M. Rashid, Power Electronics: Circuits, Devices, and Applications, PHI, 3rd Edition | 33 (+15 book bank) |
| 2 | M. D. Singh, K. B. Khanchandani, Power Electronics, Tata McGraw Hill, 2nd Edition | 12 (+15 book bank) |
| 3 | Mohan, Undeland and Robbins, Power Electronics: Converters, Applications and Design, Wiley (Student Edition), 2nd Edition | 12 |
| 4 | NPTEL lectures and notes on Power Electronics | Online |

**Internal Assessment (IA):**

Two tests will be conducted which should cover at least 80% of syllabus. The average marks of both the tests will be considered as final IA marks.

**End Semester Examination**:

1. Question paper will comprise of 6 questions, each carrying 20 marks.

2. Total 4 questions need to be solved.

3: Question No.1 will be compulsory and based on entire syllabus wherein sub questions of 2 to 5 marks will be asked.

4: Remaining questions will be selected from all the modules.

**Examination Scheme:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Module | | Lecture Hours | Marks distribution in Test | | Approximate Marks distribution in Sem. End Examination |
| Test 1 | Test 2 |
| 1 | Switching Devices | 8 | 6 | 0 | 20 |
| 2 | SCR: Triggering, Commutation , Protection | 8 | 7 | 0 | 20 |
| 3 | Single phase Controlled Rectifiers | 6 | 7 | 0 | 20 |
| 4 | Inverters | 9 | 0 | 8 | 25 |
| 5 | DC-DC converters | 8 | 0 | 7 | 20 |
| 6 | A.C. voltage Controllers and Cyclo-Convereters | 4 | 0 | 5 | 15 |

|  |  |
| --- | --- |
| **Submitted By** | **Approved By** |
| Binsy Joseph | I) Dr. D.V. Bhoir Sign: |
|  | ii) Prof. K. Narayanan Sign: |
| Sign: | iii) Prof. Shilpa patil Sign: |
|  | iv) Prof. Monica Khanore Sign: |
| **Date of Submission: 31/7/2021** | **Date of Approval:** |
| **Remarks by PAC (if any)** | |