

GOVERNMENT POLYTECHNIC, NAGPUR.
(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

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| PROGRAMME | : DIPLOMA IN CM, IT |
| LEVEL NAME | : ENGINEERING SCIENCE AND TECHNICAL ART COURSES |
| COURSE CODE | : EC308E |
| COURSE TITLE | : PRINCIPLE OF ELECTRONICS |
| PREREQUISITE | : NIL |
| TEACHING SCHEME: | TH: 04; TU: 00; PR: 02(CLOCK HRs.) |
| TOTAL CREDITS | : 05 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.) |
| TH. TEE | : 03 HRs |
| PR. TEE | : 02 HRs (Internal) |
| PT. | : 01 HR |

❖ **RATIONALE:**

The subject deals with fundamental devices used in all electronic circuits. This course prepares students understanding the construction, characteristics, operating principle and applications of electronic devices and circuit applications used in electronic circuits. Information Technology also deals with basic of materials used in electronic circuits and computer systems. The course also covers passive and active components used in electronics circuits, IC fabrication and computer systems.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to–

1. Describe the construction and characteristics of semiconductor devices.
2. Identify different semiconductor devices in electronic circuits.
3. Utilize the concept of electronics in various fields.
4. Assemble small electronic circuits.
5. Measure different parameters using test and measuring equipments.
6. Analyze electronic circuits.

❖ **COURSE DETAILS:****A. THEORY :**

| Units | Specific Learning Outcomes (Cognitive Domain) | Topics and subtopics | Hrs. |
|---|--|---|------|
| 1. Materials, Components And Circuit Elements | <ol style="list-style-type: none"> 1. Compare different types of materials. 2. Use the concept of soldering. 3. Describe the need of insulating material. 4. Classify materials. 5. Identify different resistor. 6. Estimate the value of resistor using colour coding. 7. List various applications of passive components. 8. Describe the concept of cables, switches, connectors. | <ol style="list-style-type: none"> 1.1 Types Of Materials: - conductors, Insulators, Semiconductor and magnetic. 1.2 Concept of solder, types of solder:- hard solder and soft solder. Soldering Alloys, soldering fluxes, need of flux, types of fluxes:- corrosive, intermediate and noncorrosive fluxes. 1.3 Types of passive components :- resistors, Classification, functions, specifications, color coding, symbols and units of resistors, Capacitor Classification, functions, specifications, symbol and unit of capacitor, inductors Classification, functions, specifications. 1.4 Types of resistor:- fixed resistor, wire wound resistor and LDR 1.5 Applications of resistor, capacitors and inductors. 1.6 Concept of Relays, specifications, functions and application of relays 1.7 Concept of Switches, specifications functions and applications of switches, 1.8 Concept of connectors, specifications functions and applications of connector. 1.9 Concept of cables, specifications functions and applications of cables. | 12 |
| 2. P-N Junction | <ol style="list-style-type: none"> 1. Draw energy level diagram and energy band diagram. 2. State Types of semiconductor. 3. Define semiconductor. 4. Describe formation of p-n junction semiconductor. 5. Compare different types of diodes. 6. State applications of p-n diode. | Semiconductor theory: <ol style="list-style-type: none"> 2.1 Energy level diagram, energy band diagram, Comparison of insulators, semiconductors and conductors on the basis of energy bands. 2.2 Definition of semiconductor, types of semiconductor, examples of semiconductor. 2.3 Effect of temperature on its conductivity on intrinsic semiconductor. 2.4 Types of extrinsic semiconductors. Trivalent and pentavalent impurity elements, majority and minority carriers, crystalline structure and working of P&N. | 13 |

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|--------------------------------------|--|--|----|
| | | Semiconductor Diodes. 2.5 Formation of P-N junction, and its working with forward and Reverse biasing. 2.6 Zener and avalanche mechanism 2.7 Types of P-N junction diode, Circuit diagram, working Principle of Zener diode, LED, LASER and Photodiode. 2.8 Rectification property of a P-N junction diode. | |
| 3. Bipolar Junction Transistor (BJT) | 1. Define transistor. 2. Identify PNP & NPN transistor. 3. Sketch input and output characteristics of different transistor configuration. 4. Describe the need of transistor biasing. 5. Describe different biasing methods of biasing. 6. Distinguish different biasing methods. 7. Apply the concept of transistor to use it as switch | 3.1 Types of BJT, constructions, symbols, applications, ratings, Specifications of BJT. 3.2 BJT configurations (CE, CB, CC) and their input and output characteristic. Comparison of CE, CB, CC configurations. 3.3 Operating Regions of BJT. 3.4 Definitions:- current gains (alpha and beta) and their relationship. 3.5 Condition for faithful amplification. Concepts of D.C. load line. Operating points and its stability factors. 3.6 Application of transistor:- transistor as an switch and transistor as an amplifier 3.6 Need of transistor biasing. 3.7 Biasing methods of BJT:- Circuit diagram, working principle of Fixed bias method, Voltage divider bias method and base bias with collector feedback method. | 12 |
| 4. Rectifiers And Filters | 1. Define rectifier and filters. 2. Describe half wave rectifier and full wave rectifier circuits. 3. Distinguish between HWR and FWR. 4. Memorize the need if filter. 5. Recall the operation of Filter. 6. Describe the different types of filters. 7. Distinguish different types of filters. | Rectifiers 4.1 Rectifiers Specifications and types of rectifiers. 4.2 Circuit diagram, working, waveform advantages, disadvantages, specifications of half wave rectifiers(HWR) 4.3 Circuit diagram, working, waveform advantages, disadvantages, specifications of full wave rectifiers(FWR) 4.4 comparisons of HWR and FWR. 4.5 Definitions of the terms :- peak inverse voltage, ripple factor, Filters 4.6 Necessity and types of filters. 4.7 circuit diagram, working, waveforms, advantages, disadvantages of shunt capacitor filter, series inductor, LC- types and | 10 |

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|-----------------------|---|---|-----------|
| | | II types filter 4.8 Function of bleeder resistor, comparisons of all filters. | |
| 5. Voltage Regulators | 1. Define Voltage Regulation. 2. Illustrate the need of regulation. 3. Demonstrate Zener diode as a voltage regulator. 4. Describe working of series and shunt regulators using BJT. 5. Compare different voltage regulators. 6. Describe Zener diode as a voltage regulator. | 5.1 Definition of voltage regulation, Block diagram, working and demerits of unregulated power supply(URPS) 5.2 Necessity and types of voltage regulation, Zener diode as voltage Regulator and its merits and demerits, concept of switched mode power supply (SMPS). 5.3 Circuit diagram ,working, merits, demerits, of series and shunt regulators using BJT 5.4 Definition of load and line regulation. 5.5 Comparison of all voltage regulators. | 06 |
| 6. Oscillators | 1. Define Feedback. 2. Discuss positive and negative feedback 3. Define oscillators. 4. Categorize oscillators. 5. Describe working of different oscillators 6. Memorize advantages and disadvantages of oscillator.. 7. Identify the given circuit of oscillator and describe. | Feedback circuits: 6.1 Definition, types, and comparison of feedbacks. 6.2 Effects and advantages of negative feedback in amplifier 6.3 Block diagram of negative feedback 6.4. Block diagram of positive feedback Oscillators 6.5 LC tank circuit, meaning of damped and undamped oscillation. 6.6 Classification Of oscillators. Barkhausen criteria for sustained oscillation. 6.7 Circuit diagram, working, advantages, disadvantages and applications of Hartley oscillator, colpitt's oscillators and RC phase shift oscillator and crystal oscillator. | 11 |
| Total Hrs. | | | 64 |

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

| Practicals | Specific Learning Outcomes (Psychomotor Domain) | Units | Hrs. |
|------------------|---|--|------|
| 1 | Measure Values of resistors using colour codes and multimeter | Materials, components and circuit elements | 2 |
| 2 | Identify various controls of test and measuring equipment(Digital Multimeter, CRO, Function Generator) | | 4 |
| 3 | Plot V-I characteristics of P-N Junction Diode. | | 2 |
| 4 | Plot V-I characteristics of Zener Diode and identify breakdown voltage in reverse bias condition. | | 2 |
| 5 | Plot the input and output characteristics of BJT in CE mode and find input resistance, output resistance and current gain. | Bipolar junction transistor | 2 |
| 6 | Plot the input and output characteristics of BJT in CB mode and find input resistance, output resistance and Current gain | | 2 |
| 7 | Assemble fixed bias circuits and voltage divider Transistor biasing circuits on bread board and measure different parameters. | | 2 |
| 8 | Analyze the effect of different values of filters on the output HWR and Plot I/O waveform of HWR. | Rectifiers and Filters | 4 |
| 9 | Plot I/O waveforms of FWR and Show the effect of Different Filter on the output of FWR. | | 4 |
| 10 | Assemble Zener diode as a voltage regulator and Draw V-I characteristic of Zener diode in reverse bias mode. | Voltage regulators | 4 |
| 11 | Connect input to smps and measure output | | 2 |
| 12 | Construct Hatley oscillator and find output frequency | Oscillators | 2 |
| 13 | Construct R.C Phase shift oscillator and find output frequency | | 2 |
| Skill Assessment | | | 2 |
| Total Hrs | | | 32 |

❖ SPECIFICATION TABLE FOR THEORY PAPER:

| Unit No. | Units | Levels from Cognition Process Dimension | | | Total Marks |
|----------|--|---|---------------|----------------|----------------|
| | | R | U | A | |
| 01 | Materials, components and circuit elements | 02(02) | 08(06) | 00(00) | 10(08) |
| 02 | P-N Junction | 06(00) | 10(08) | 00(00) | 16(08) |
| 03 | Bipolar Junction Transistor | 06(00) | 08(00) | 00(06) | 14(06) |
| 04 | Rectifiers and Filters | 04(02) | 06(04) | 00(00) | 10(06) |
| 05 | Voltage Regulators | 02(04) | 00(00) | 06(00) | 08(04) |
| 06 | Oscillators | 02(04) | 04(04) | 06(00) | 12(08) |
| | Total | 22(12) | 36(22) | 12 (06) | 70 (40) |

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

| Q. No | Bit 1 | | | Bit 2 | | | Bit 3 | | | Bit 4 | | | Bit 5 | | | Bit 6 | | | Option |
|-------|-------|---|---|-------|---|---|-------|---|---|-------|---|---|-------|---|---|-------|---|---|--------|
| | T | L | M | T | L | M | T | L | M | T | L | M | T | L | M | T | L | M | |
| 01 | 1 | R | 2 | 2 | R | 2 | 3 | R | 2 | 5 | R | 2 | 6 | R | 2 | 1 | R | 2 | 5/7 |
| | 4 | R | 2 | | | | | | | | | | | | | | | | |
| 02 | 2 | R | 4 | 1 | U | 4 | 1 | U | 4 | 2 | U | 4 | 2 | U | 4 | | | | 3/5 |
| 03 | 3 | R | 4 | 2 | U | 4 | 3 | U | 4 | 4 | U | 4 | 5 | R | 4 | | | | 3/5 |
| 04 | 4 | R | 4 | 3 | U | 4 | 6 | U | 4 | 6 | R | 4 | 6 | U | 4 | | | | 3/5 |
| 05 | 2 | U | 6 | 4 | U | 6 | 3 | A | 6 | | | | | | | | | | 2/3 |
| 06 | 5 | A | 6 | 6 | A | 6 | 1 | U | 6 | | | | | | | | | | 2/3 |

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ ASSESSMENT AND EVALUATION SCHEME:

| | What | | To Whom | Frequency | Max Marks | Min Marks | Evidence Collected | Course Outcomes |
|-----------------------------|-------------------------------|-----------------------|----------|--|-----------------------|-----------|----------------------------------|-----------------|
| Direct Assessment Theory | CA (Continuous Assessment) | Progressive Test (PT) | Students | Two PT (average of two tests will be computed) | 20 | -- | Test Answer Sheets | 1, 2, 3 |
| | | Assignments | | Continuous | 10 | — | Assignment Book / Sheet | 1, 2, 3 |
| | TEE (Term End Examination) | End Exam | Students | End Of the Course | 70 | 28 | Theory Answer Sheets | 1, 2, 3 |
| | | | | Total | 100 | 40 | | |
| Direct Assessment Practical | CA (Continuous Assessment) | Skill Assessment | Students | Continuous | 20 | -- | Rubrics & Assessment Sheets | 4,5,6 |
| | | Journal Writing | | Continuous | 05 | -- | Journal | 4,5,6 |
| | | | | TOTAL | 25 | 10 | | |
| | TEE (Term End Examination) | End Exam | Students | End Of the Course | 50 | 20 | Rubrics &Practical Answer Sheets | 4,5,6 |
| Indirect Assessment | Student Feedback on course | | Students | After First Progressive Test | Student Feedback Form | | 1, 2, 3, 4,5,6 | |
| | End Of Course | | | End Of The Course | Questionnaires | | | |

❖ **SCHEME OF PRACTICAL EVALUATION:**

| S.N. | Description | Max. Marks |
|------|---|------------|
| 1 | Drawing circuit diagram, writing observation table ,draw waveforms and writing procedure etc. | 10 |
| 2 | Performance of the practical | 20 |
| 3 | Taking observations ,Calculation, Result, Drawing Graphs(if any) | 10 |
| 4 | Viva voce | 10 |
| | TOTAL | 50 |

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

| Course Outcomes | Program Outcomes (POs) | | | | | | | | | | PSO | |
|-----------------|------------------------|---|---|---|---|---|---|---|---|----|-----|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 1 | 2 |
| 1 | 3 | - | - | - | - | - | - | - | - | 3 | - | - |
| 2 | 3 | - | - | - | - | - | - | - | - | 3 | - | - |
| 3 | 3 | - | - | - | - | - | - | - | - | 3 | - | - |
| 4 | 3 | - | 2 | 2 | - | - | 2 | 2 | - | 3 | - | - |
| 5 | 3 | - | 2 | 2 | - | - | 2 | 2 | - | 3 | - | - |
| 6 | 3 | - | 2 | 2 | - | - | 2 | 2 | - | 3 | - | - |

❖ **REFERENCE & TEXT BOOKS:**

| S.N. | Title | Author, Publisher, Edition and Year Of publication | ISBN Number |
|------|----------------------------------|--|---------------|
| 1. | Principles of Electronics | V.K.Mehta, S.Chand & Company Ltd., Reprint, 1996 | 8121910536 |
| 2. | Applied Electronics | R S. Sedha, S. Chand & Company Ltd.2005 | 8121927838 |
| 3. | Basic Electronics | Grob, Tata Mc Graw Hill | 9780070634329 |
| 4. | Electronics Devices and circuits | S.Salivahanan, Tata Mc Graw Hill | 9780070660496 |
| 5. | Electronic Principles | Albert Malvino & David J Bates, Tata Mc Graw Hill | 9780070634244 |

❖ **E-REFERENCES:**

- <http://nptel.ac.in/courses/117103063>
- <http://www.electronicsforu.com>
- <https://www.youtube.com/watch?v=w8Dq8bITmSA>

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

1. Ammeter MI 0-5-10 A
2. Voltmeter MI 0-150-300 V
3. Regulated Power Supply
4. Digital Multi-meter
5. Cathode Ray Oscilloscope (0-50 MHZ)
6. Function Generator

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

| S.N. | Name | Designation | Institute / Industry |
|------|-------------------------|---|-------------------------------------|
| 1. | Mr. S. S. Tadas | HOD, Electronics and Telecommunications | Government Polytechnic, Nagpur. |
| 2. | Mr. D. A. Brahamankar | Lecturer, Government Polytechnic, Nagpur. | Government Polytechnic, Nagpur. |
| 3. | Mrs. U. P. Potdar | Lecturer, Government Polytechnic, Nagpur. | Government Polytechnic, Nagpur. |
| 4. | Mr. Sandip V Darwhankar | Director | Beta computronicspvt ltd , Nagpur |
| 5. | Mrs. Gajala Ali | Head Electronics | Anjuman Polytechnic , Nagpur |
| 6. | Mr. S M Kale | Lecturer Electronics | Government Polytechnic, Gadchiroli. |

 (Member Secretary PBOS)

 (Chairman PBOS)