# BEHARA
## COLLEGE OF ENGINEERING AND TECHNOLOGY
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## Comprehensive Guide: Double Major, Minor, Open Electives & Skill Enhancement Courses

**Document Version:** R23 (Effective from 2023-24)
**Applicable Branches:** ECE, EEE, CSE, MECH, CSEDS

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## PROGRAM OVERVIEW

### Total Program Credits: 160

| Category | Credits | Percentage | Semesters |
|---|---|---|---|
| Humanities & Management | 13 | 8% | I to VIII |
| Basic Sciences | 20 | 13% | I to II |
| Engineering Sciences | 23.5 | 14% | I to IV |
| Professional Core | 54.5 | 34% | I to VIII |
| **Electives (PE + OE)** | **27** | **17%** | **V to VIII** |
| **Skill Enhancement** | **6** | **3.75%** | **V to VII** |
| Internships & Project | 16 | 10% | II, III, VIII |
| Mandatory Courses | Non-credit | - | I to VIII |

**Total Electives & Skills: 33 credits (20.6% of program)**

## DOUBLE MAJOR PROGRAM

### Status: NOT OFFICIALLY OUTLINED IN R23

The JNTUGV R23 regulations focus on **Single Major + Minor/Honors** model rather than Double Major.

### Alternative Paths Available:

#### Option 1: Major + Minor (RECOMMENDED)
- **Main Degree:** B.Tech in your chosen branch (160 credits)
- **Minor Degree:** 12 credits from another discipline
- **Total Credits:** 172 credits
- **Duration:** 4 years standard
- **Degree Awarded:** "B.Tech in [Major] with Minor in [Minor Discipline]"

#### Option 2: Major + Honors (RECOMMENDED)
- **Main Degree:** B.Tech in your chosen branch (160 credits)
- **Honors Component:** 15 additional specialized credits
- **Total Credits:** 175 credits
- **Duration:** 4 years (simultaneous completion)
- **Degree Awarded:** "B.Tech (Honors) in [Branch]"

#### Option 3: Major + Minor + Honors (ADVANCED)
- **Main Degree:** 160 credits
- **Minor:** 12 credits (via Open Electives)
- **Honors:** 15 additional credits
- **Total Credits:** 187 credits
- **Duration:** 4-4.5 years (may require careful planning)
- **Note:** Subject to institutional approval and feasibility

### Double Major via Extended Program:

**If seeking true Double Major (two full degrees), consult:** - Department Head / Academic Dean - University Office of Registrar - Feasibility: Typically requires 5+ years or accelerated completion

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## MINOR DEGREE PROGRAM

### Eligibility
- All B.Tech students in major stream
- No additional admission needed
- Can register anytime from Semester III onwards

## Requirements: 12 Credits Total

*Structure:*

```
Minor Degree = Compulsory Courses + Electives

├─ Compulsory Courses: 2 courses (6 credits)
│    └─ Select 2 mandatory courses from chosen Minor discipline
│
├─ Elective Courses: Minimum 2 courses (6 credits)
│    └─ Select from Open Electives pool (each worth 3 credits)
│
└─ Total: Minimum 12 credits
```

## Compulsory Course Requirements:

These are discipline-specific mandatory courses (examples):

**Minor in Computer Science & Engineering:** - Database Management Systems (3 credits) - Data Structures (3 credits)

**Minor in Electronics & Communication:** - Digital Signal Processing (3 credits) - Communication Systems (3 credits)

**Minor in Mechanical Engineering:** - Fluid Mechanics (3 credits) - Heat Transfer (3 credits)

## Waiver Provision:
- If compulsory courses already completed in major, can be waived
- Must register for additional elective course as replacement
- Requires department approval

## Elective Course Selection:
- Choose from **Open Electives pool** (minimum 2, at 3 credits each)
- Can overlap with major's OE selections
- Interdisciplinary courses (OE) count toward minor electives

## Example Pathways:

### Example 1: ECE Major with CSE Minor

```
Compulsory (6 credits):
  • Database Management Systems (3)
  • Data Structures (3)

Electives (6 credits): Select 2 from:
  • AI for Everyone (3)
  • Cybersecurity Essentials (3)
  • Cloud Computing Basics (3)
  • Digital Marketing (3)
```

```
Total: 12 credits ✓ CSE Minor Awarded
```

**Example 2: MECH Major with EEE Minor**

```
Compulsory (6 credits):
  • Power Systems Analysis (3)
  • Electrical Machines (3)

Electives (6 credits): Select 2 from:
  • Renewable Energy (3)
  • Environmental Studies (3)
  • Entrepreneurship (3)

Total: 12 credits ✓ EEE Minor Awarded
```

**Minor Degree Completion Timeline:**

- **Registration:** Sem III onwards
- **Completion:** Must complete all 12 credits by end of Sem VIII
- **Evaluation:** Same evaluation as major courses
- **Minimum Grade:** Must pass all courses (minimum 40% marks)

**Degree Certificate Notation:**
```
Bachelor of Technology in [Major Branch]
with Minor in [Minor Discipline]
```

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# PROFESSIONAL ELECTIVES (PE)

**Overall Structure**

- **Total Courses:** 5 per branch
- **Credits per Course:** 3 credits each
- **Total PE Credits:** 15 credits (9.4% of program)
- **Offered in:** Semesters V-VIII

**Branch-wise PE Offerings:**

*ECE - Electronics & Communication Engineering*

**PE-I (Semester V):** - Advanced Semiconductors - RF Circuit Design - Signal Processing - Wireless Communication

**PE-II (Semester VI):** - VLSI Design - Antenna Theory - Embedded Systems Design - Optical Communication

**PE-III (Semester VI/VII):** - Digital Signal Processing - Control Systems - Power Electronics - Microwave Engineering

**PE-IV (Semester VII):** - Communication Networks - Image Processing - Bio-Medical Engineering - IoT Systems

**PE-V (Semester VIII):** - Machine Learning Applications - Radar Systems - Electronic Device Physics - Advanced Control Systems

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## EEE - Electrical & Electronics Engineering

**PE-I (Semester V):** - Power System Analysis - High Voltage Engineering - Power Electronics - Electrical Machines II

**PE-II (Semester VI):** - Power Generation Technologies - Smart Grid Technology - Power System Protection - Motor Drives

**PE-III (Semester VI/VII):** - Renewable Energy Systems - Energy Storage Systems - Power Quality - Advanced Control Systems

**PE-IV (Semester VII):** - Microgrid Technology - Power System Economics - FACTS Devices - Electric Vehicle Technology

**PE-V (Semester VIII):** - Distributed Generation - Power System Stability - AI in Power Systems - Energy Management Systems

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## CSE - Computer Science & Engineering

**PE-I (Semester V):** - Cloud Computing - Cybersecurity - Big Data Analytics - Artificial Intelligence

**PE-II (Semester VI):** - Machine Learning - Data Mining - Internet of Things - Blockchain

**PE-III (Semester VI/VII):** - Natural Language Processing - Computer Vision - Advanced Database Systems - Distributed Systems

**PE-IV (Semester VII):** - Software Testing - DevOps - Mobile App Development - Web Services

**PE-V (Semester VIII):** - Deep Learning - Quantum Computing - Game Development - AR/VR Technologies

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## MECH - Mechanical Engineering

**PE-I (Semester V):** - Advanced Manufacturing - Finite Element Analysis - Robotics - Thermal Engineering

**PE-II (Semester VI):** - CAD/CAM - Control Systems - Renewable Energy - Tribology

**PE-III (Semester VI/VII):** - Computational Fluid Dynamics - Advanced Vibrations - Mechatronics - Material Science

**PE-IV (Semester VII):** - Quality Control - Industrial Automation - Composite Materials - Additive Manufacturing

**PE-V (Semester VIII):** - Advanced Machine Design - Optimization Techniques - Energy Conversion - Sustainable Engineering

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## CSEDS - Computer Science & Engineering (Data Science)

**PE-I (Semester V):** - Advanced Statistics - Data Visualization - Database Design - Python for Data Science

**PE-II (Semester VI):** - Machine Learning Algorithms - Big Data Tools - Data Warehousing - Statistical Analysis

**PE-III (Semester VI/VII):** - Deep Learning - Natural Language Processing - Time Series Analysis - Data Ethics

**PE-IV (Semester VII):** - Computer Vision - Predictive Analytics - Real-time Analytics - Data Engineering

**PE-V (Semester VIII):** - Reinforcement Learning - Recommendation Systems - Causal Inference - Advanced Analytics

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### PE Selection Guidelines

#### Rules:
1. **Choose One per Semester:** Select 1 PE course per semester (V, VI, VII)
2. **Choose Two in Final Semester:** Select 2 PE courses in Semester VIII
3. **Total Selection:** 5 PE courses across all semesters
4. **No Duplication:** Cannot repeat same course
5. **Prerequisites:** Check individual course prerequisites

#### Recommendations for Specialization Tracks:

**ECE - Communication & Signal Processing Track:** - Sem V: RF Circuit Design - Sem VI: Antenna Theory - Sem VII: Microwave Engineering - Sem VIII: Communication Networks + Radar Systems

**EEE - Renewable Energy Track:** - Sem V: Power System Analysis - Sem VI: Power Generation Technologies - Sem VII: Renewable Energy Systems - Sem VIII: Smart Grid Technology + Energy Management Systems

**CSE - AI & Machine Learning Track:** - Sem V: Artificial Intelligence - Sem VI: Machine Learning - Sem VII: Computer Vision OR NLP - Sem VIII: Deep Learning + Reinforcement Learning

**MECH - Advanced Manufacturing Track:** - Sem V: Advanced Manufacturing - Sem VI: CAD/CAM - Sem VII: Industrial Automation - Sem VIII: Additive Manufacturing + Composite Materials

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## OPEN ELECTIVES (OE)

### Overall Structure
- **Total OE Courses Available:** 8+ (interdisciplinary pool)
- **Selection Required:** 4 courses minimum
- **Credits per Course:** 3 credits each
- **Total OE Credits:** 12 credits (7.5% of program)
- **Offered in:** Semesters V-VIII

### Available Open Electives (Common Pool):

| Code | Course Title | Discipline | Use for Minor? |
|------|-------------|-----------|----------------|
| OE-1 | Economics for Engineers | Management | ✓ |
| OE-2 | Indian Constitution | Social Science | ✓ |
| OE-3 | Environmental Studies | Science | ✓ |
| OE-4 | Human Values & Professional Ethics | Humanities | ✓ |
| OE-5 | Artificial Intelligence for Everyone | Technology | ✓ |
| OE-6 | Cyber Security Essentials | Technology | ✓ |
| OE-7 | Entrepreneurship & Innovation | Management | ✓ |
| OE-8 | Digital Marketing Fundamentals | Management | ✓ |

*Additional OE courses may be offered by departments*

### OE Selection Guidelines:

#### For Major Program (4 Courses):
- **No Restrictions:** Select any 4 OE courses from available pool
- **Flexibility:** Mix disciplines per interest
- **Repeat Not Allowed:** Cannot take same OE twice
- **Prerequisites:** Generally none; check specific course

#### For Minor Program (2+ Courses via OE):
- **From OE Pool:** Select minimum 2 OE courses
- **Relevance:** Should align with minor discipline (recommended)
- **Example:** For CSE Minor, select "AI for Everyone" + "Cybersecurity Essentials"

```
Semester V:   OE-I (1 course, 3 credits)
Semester VI:  OE-II (1 course, 3 credits)
Semester VII: OE-III (1 course, 3 credits)
Semester VIII: OE-IV (1 course, 3 credits)
              _____

              Total: 4 courses = 12 credits
```

**Strategic OE Selection Examples:**

**ECE Student - IoT & Embedded Systems Focus:** - OE-1: AI for Everyone (AI basics) - OE-2: Cyber Security Essentials (security for IoT) - OE-3: Entrepreneurship & Innovation (startups) - OE-4: Digital Marketing (tech product marketing)

**MECH Student - Sustainable Engineering Focus:** - OE-1: Environmental Studies (sustainability) - OE-2: Entrepreneurship & Innovation (green tech startups) - OE-3: Economics for Engineers (cost analysis) - OE-4: Indian Constitution (regulations/compliance)

**CSE Student - Data Science Minor Path:** - OE-1: AI for Everyone (AI fundamentals) - OE-2: Economics for Engineers (business analytics) - OE-3: Entrepreneurship & Innovation (data startups) - OE-4: Digital Marketing Fundamentals (analytics in marketing)

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## SKILL ENHANCEMENT COURSES (SEC)

**Overall Structure**
- **Total SEC Courses:** 5
- **Credits:** 6 total (1+1+1+1+2)
- **Categories:** 4 domain-specific + 1 soft skills
- **Offered in:** Semesters V-VII
- **Percentage:** 3.75% of total program
- **Completion:** Mandatory for all students

**SEC Framework:**

*SEC-1: Domain Basic Skills I*
- **Semester:** V
- **Credits:** 1
- **Category:** Domain Basic
- **Examples by Branch:**
    - **ECE:** Programming for IoT / Embedded Systems Basics
    - **EEE:** Power Electronics Basics / Power System Fundamentals
    - **CSE:** Python Programming Basics / Cloud Computing Fundamentals
    - **MECH:** CAD Fundamentals / Manufacturing Basics
    - **CSEDS:** Python for Data Science / Data Analytics Fundamentals

### SEC-2: Domain Basic Skills II

- **Semester:** VI
- **Credits:** 1
- **Category:** Domain Basic
- **Examples by Branch:**
  - **ECE:** Advanced Embedded Programming / Communication Protocols
  - **EEE:** Advanced Python / Control Systems Simulation
  - **CSE:** Web Development Basics / Database Fundamentals
  - **MECH:** Advanced CAD / FEA Basics
  - **CSEDS:** Data Preprocessing & Cleaning / SQL Basics

### SEC-3: Domain Advanced Skills I

- **Semester:** VI
- **Credits:** 1
- **Category:** Domain Advanced
- **Examples by Branch:**
  - **ECE:** FPGA Design / 5G Communication Basics
  - **EEE:** Renewable Energy Technologies / Smart Grid Introduction
  - **CSE:** AI & Deep Learning Basics / DevOps Fundamentals
  - **MECH:** Additive Manufacturing / Advanced FEA
  - **CSEDS:** Machine Learning Implementation / Advanced Analytics

### SEC-4: Domain Advanced Skills II

- **Semester:** VII
- **Credits:** 1
- **Category:** Domain Advanced
- **Examples by Branch:**
  - **ECE:** Edge Computing / 5G Architecture
  - **EEE:** Blockchain for Energy / IoT in Smart Grid
  - **CSE:** Containerization & Kubernetes / Advanced DevOps
  - **MECH:** Industry 4.0 / Advanced Robotics
  - **CSEDS:** Deep Learning Advanced / Big Data Implementation

### SEC-5: Soft Skills

- **Semester:** VII
- **Credits:** 2
- **Category:** Soft Skills (Universal)
- **Content:**
  - Professional Communication
  - Leadership & Team Management
  - Presentation Skills
  - Conflict Resolution

- Time Management
- Emotional Intelligence

**SEC Selection Process:**

*Mandatory Enrollment:*
- All 5 SEC courses are **MANDATORY**
- No selection/choice (uniform curriculum per branch)
- Prerequisites: None for basic skills

*Completion Requirements:*
- **Attendance:** 75% minimum for SEC courses
- **Passing Grade:** Minimum 40% marks
- **No Exemptions:** All students must complete all 5 SEC courses
- **Weightage:** SEC grades appear on transcript; impact on CGPA

*Evaluation:*
- **Assessment Type:** Practical/Project-based + Internal evaluation
- **External Exam:** No semester-end examination for most SEC
- **Continuous Evaluation:** Throughout semester
- **Lab/Workshop Based:** Hands-on implementation

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## YEAR-WISE DISTRIBUTION

### YEAR 1 (Semesters I-II): Foundation Phase

*Status: NO ELECTIVES*

| Semester | PE Courses | OE Courses | SEC Courses | Total Credits |
|----------|-----------|-----------|-------------|---------------|
| I | - | - | - | 0 |
| II | - | - | - | 0 |

**Focus:** Core foundation engineering courses (Mathematics, Physics, Chemistry, Programming, Graphics)

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### YEAR 2 (Semesters III-IV): Core Specialization Phase

*Status: NO ELECTIVES (yet)*

| Semester | PE Courses | OE Courses | SEC Courses | Total Credits |
|----------|-----------|-----------|-------------|---------------|
| III | - | - | - | 0 |
| IV | - | - | - | 0* |

*Honors registration opens after Semester III results (optional)

**Focus:** Core discipline-specific courses

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### YEAR 3 (Semesters V-VI): Elective & Skill Phase Begins

*Semester V:*

| Component | Count | Credits | Courses |
|---|---|---|---|
| PE | 1 | 3 | PE-I: Choose 1 from 4 options |
| OE | 1 | 3 | OE-I: Choose 1 from 8 options |
| SEC | 1 | 1 | SEC-1: Domain Basic Skills I |
| **Semester Total** | - | **7** | - |

*Semester VI:*

| Component | Count | Credits | Courses |
|---|---|---|---|
| PE | 1 | 3 | PE-II: Choose 1 from 4 options |
| OE | 1 | 3 | OE-II: Choose 1 from 8 options |
| SEC | 2 | 2 | SEC-2 (1 cr) + SEC-3 (1 cr) |
| **Semester Total** | - | **8** | - |

**Year 3 Total:** 2 PE + 2 OE + 3 SEC = 15 credits

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### YEAR 4 (Semesters VII-VIII): Advanced & Final Phase

*Semester VII:*

| Component | Count | Credits | Courses |
|---|---|---|---|
| PE | 1 | 3 | PE-III: Choose 1 from 4 options |
| OE | 1 | 3 | OE-III: Choose 1 from 8 options |
| SEC | 2 | 3 | SEC-4 (1 cr) + SEC-5 (2 cr) |
| **Semester Total** | - | **9** | - |

*Semester VIII:*

| Component | Count | Credits | Courses |
|---|---|---|---|
| PE | 2 | 6 | PE-IV & PE-V: Choose 2 from 4 options each |
| OE | 1 | 3 | OE-IV: Choose 1 from 8 options |
| Internship & Project | - | 16 | Full Semester Internship + Project Work |

| Component | Count | Credits | Courses |
|---|---|---|---|
| **Semester Total** | - | **25** | - |

**Year 4 Total:** 3 PE + 2 OE + 2 SEC + Internship = 27 credits

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**Program-wide Summary Table**

| Component | Sem V | Sem VI | Sem VII | Sem VIII | **Total** |
|---|---|---|---|---|---|
| **PE** | 1 | 1 | 1 | 2 | **5** |
| **PE Credits** | 3 | 3 | 3 | 6 | **15** |
| **OE** | 1 | 1 | 1 | 1 | **4** |
| **OE Credits** | 3 | 3 | 3 | 3 | **12** |
| **SEC** | 1 | 2 | 2 | - | **5** |
| **SEC Credits** | 1 | 2 | 3 | - | **6** |
| **Elective Total** | 7 | 8 | 9 | 9 | **33** |

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## HONORS PROGRAM

### Eligibility Criteria

*Basic Eligibility:*
- CGPA ≥ 7.0 at end of **III Semester**
- **NO BACKLOGS** in any course
- Minimum attendance as per regulations

*Branch Eligibility:*
- Available in ALL branches: ECE, EEE, CSE, MECH, CSEDS
- Major degree required
- Honors in different branch NOT allowed

### Structure & Credits

*Total Credits:*
```
Regular B.Tech Degree:     160 credits
Honors Component:        +  15 credits
————————————————————————————————————
Total for Honors Degree:   175 credits
```

*Courses:*
- **5 Specialized Courses** × 3 credits = 15 credits
- Selected from advanced/specialized courses within same discipline

## Registration & Timeline

### *Registration Window:*
- **Opens:** After Semester III results declared
- **Registration:** During course registration for Semester IV
- **Maximum Courses:** 2 per semester starting from Semester V
- **Timeframe:** Semesters V-VIII (can extend beyond if needed)

### *Schedule Management:*
- **Separate Class Work:** Yes, separate from regular classes
- **Separate Timetable:** Yes, dedicated slots for Honors courses
- **Separate Attendance:** Tracked separately
- **75% Attendance:** Minimum required for Honors courses

## Course Selection Rules

### *Guidelines:*
1. **From Same Discipline:** All 5 courses must be from major branch
2. **No Double Counting:** Cannot use courses counting toward major requirement
3. **No Equivalent Courses:** Cannot use courses with substantially equivalent content
4. **Prerequisite Check:** Must satisfy course prerequisites
5. **Level:** Must be specialized/advanced level courses

### *Online Course Options:*
- **SWAYAM Courses:** Permitted
- **Minimum Duration:** 12 weeks for 3-credit, 8 weeks for 2-credit courses
- **Quality:** Must meet university approval criteria
- **Enrollment:** Must register through university portal

## Evaluation & Grading

### *Evaluation:*
- **Same Standards:** Same as regular B.Tech courses
- **No Class Division:** Honors courses NOT eligible for class/rank
- **Pass/Fail:** Must pass all 5 Honors courses
- **Grade Points:** Regular grading scheme applies

### *Performance Tracking:*
- **Separate Transcript:** Honors courses listed separately
- **CGPA Impact:** Honors grades included in overall CGPA
- **Transcript Notation:** "Honors Program - [Courses Completed]"

### Dropping from Honors

*If Student Drops/Terminated:*
- **Credits:** Extra credits NOT converted to electives
- **Impact:** Remain as extra credits (not counted for degree)
- **Transcript:** Separate sheet shows completed Honors courses
- **Degree:** Regular B.Tech awarded (no Honors notation)

### Degree Certificate

*Notation:*
```
Bachelor of Technology (Honors) in [Branch]
```

*Examples:*
- B.Tech (Honors) in Electronics and Communication Engineering
- B.Tech (Honors) in Computer Science and Engineering
- B.Tech (Honors) in Mechanical Engineering

### Honors Course Examples:

**ECE Honors Track - VLSI & Signal Processing:** - Advanced Semiconductors - VLSI Design Methodologies - Advanced Signal Processing - System-on-Chip Design - Digital Communication Advanced

**CSE Honors Track - Artificial Intelligence:** - Advanced Machine Learning - Deep Neural Networks - Natural Language Processing - Computer Vision Advanced - Reinforcement Learning

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## COURSE SELECTION GUIDELINES

### Timeline for Elections

| Event | Timeline |
|---|---|
| Honors Registration | After Sem III results (during Sem IV) |
| PE/OE Registration | Start of each semester (V-VIII) |
| Course Code Upload | 1 week before semester begins |
| Add/Drop Period | First 2 weeks of semester |
| Mid-Sem Tests | Weeks 5-6 of semester |
| Freeze Date | 12th week of semester |

### Choosing Professional Electives (PE)

*Step 1: Assess Your Goals*
- **Specialization:** What field do you want to focus?
- **Career Path:** Consulting, Research, Industry, Further Studies?

- **Interests:** Which domain topics excite you?

### Step 2: Map to Track

- **Communication Track:** Wireless, Antenna, RF for ECE
- **Power Track:** Power Systems, Generation, Smart Grid for EEE
- **AI Track:** Machine Learning, Deep Learning for CSE
- **Manufacturing Track:** CAD/CAM, Automation for MECH

### Step 3: Build Coherence

```
Example ECE Signal Processing Track:
Sem V (PE-I):   → Digital Signal Processing
Sem VI (PE-II):  → VLSI Design (for DSP chips)
Sem VII (PE-III): → Microwave Engineering (signal handling)
Sem VIII (PE-IV): → Communication Networks (signal transmission)
Sem VIII (PE-V):  → Advanced Control (signal systems)
```

## Choosing Open Electives (OE)

### Approach 1: Minor Degree Path

- **Goal:** Earn minor in another discipline
- **OE Selection:** Choose 2+ from minor discipline
- **Total:** Combine with 2 compulsory minor courses
- **Result:** Minor degree awarded

### Approach 2: Skill Development Path

- **Goal:** Broad interdisciplinary skills
- **OE Selection:** Mix of tech + management + humanities
- **Example:** AI for Everyone + Entrepreneurship + Economics + Ethics

### Approach 3: Career Enhancement Path

- **Goal:** Build resume skills
- **OE Selection:** Cybersecurity + Digital Marketing + Innovation
- **Result:** Marketable skill set for industry

## Choosing Skill Enhancement Courses (SEC)

### NOTE: Mandatory for All

- All 5 SEC courses are **REQUIRED**
- No choice in individual courses
- Uniform per branch
- Registration automatic per curriculum

**ECE Typical SEC Path:** - Sem V: Programming for IoT (1 credit) - Sem VI: Cloud Computing Basics (1 credit) - Sem VI: 5G/Edge Computing Basics (1 credit) - Sem VII: Advanced IoT/5G Tech (1 credit) - Sem VII: Professional Communication Skills (2 credits)

**CSE Typical SEC Path:** - Sem V: Python Programming (1 credit) - Sem VI: Data Analytics Fundamentals (1 credit) - Sem VI: Machine Learning Basics (1 credit) - Sem VII: Advanced ML/AI (1 credit) - Sem VII: Leadership & Communication (2 credits)

## Academic Load Management

*Recommended Course Load per Semester:*
```
Semester V-VI:    12-14 credits (comfortable)
Semester VII:     12-14 credits (comfortable)
Semester VIII:    25 credits (includes Internship+Project - unavoidable)
```

*Warning Signs of Overload:*
- More than 5 non-mandatory courses + SEC + core courses
- Insufficient time for each course
- Multiple major projects overlapping
- **Solution:** Defer non-essential electives to next semester

## Consultation & Mentorship

*Seek Guidance From:*
1. **Faculty Advisor:** Assigned to your batch
    – Helps with course planning
    – Career guidance
    – Academic mentoring
2. **Department Head / Academic Coordinator:**
    – Clarifies prerequisites
    – Discusses specialization options
    – Approves minor programs
3. **Peers & Seniors:**
    – Real experiences with courses
    – Course difficulty levels
    – Faculty teaching styles
4. **Online Resources:**
    – Course syllabi (available on portal)
    – Student reviews on internal forums
    – Previous year course feedback

### Prerequisite Check

*Required Before Registration:*
- ☐ Have I completed all prerequisites?
- ☐ Are there any corequisites?
- ☐ Am I waived for any compulsory courses?
- ☐ Do I have permission for restricted courses?

*Common Prerequisites:*
- **Signal Processing** → Prerequisites: Signals & Systems
- **Control Systems** → Prerequisites: Differential Equations
- **VLSI Design** → Prerequisites: Digital Logic
- **Data Mining** → Prerequisites: Databases, Statistics
- **Advanced ML** → Prerequisites: Machine Learning, Linear Algebra

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## FREQUENTLY ASKED QUESTIONS (FAQs)

### Electives & Choice

**Q: Can I take both Minor degree and Honors?**
A: Yes! Minor uses Open Electives (12 credits). Honors uses specialized courses in your major (15 credits). Both can be pursued simultaneously if you meet Honors eligibility (CGPA ≥ 7.0 after Sem III).

**Q: What if I fail an elective course?**
A: You must retake it in the next offering. Register for supplementary exam. If still failing, must repeat.

**Q: Can I change electives after registration?**
A: Yes, within Add/Drop period (first 2 weeks). After that, change requires written permission from Dean.

**Q: What if a PE course has low enrollment?**
A: Courses with <10 students may be merged or cancelled. You'll be offered alternatives or credit waived.

### Minor Degree

**Q: Can I do minor in same discipline as my major?**
A: No. Minor must be in DIFFERENT discipline.

**Q: How many minors can I pursue?**
A: Typically ONE. Pursuing multiple minors requires special approval.

**Q: Will minor affect my placement?**
A: No negative impact. Many companies value interdisciplinary skills. Can be advantage for certain roles.

**Q: When should I register for minor?**
A: Anytime from Sem III onwards. No fixed deadline, but earlier is better for course planning.

## Honors

**Q: What's the cutoff CGPA for Honors?**
A: Minimum 7.0 at end of Sem III. No backlogs. Higher CGPA preferred for advanced Honors courses.

**Q: Can I take Honors courses online?**
A: Yes, SWAYAM courses permitted with minimum 12-week duration. Must be pre-approved.

**Q: Does Honors help with placements?**
A: Yes. Honors notation on degree shows specialization. Valued for research/higher studies.

**Q: Can I drop Honors after starting?**
A: Yes, but courses completed won't convert to regular electives. Remain as extra credits.

## Skill Enhancement

**Q: Are SEC courses graded?**
A: Yes. Grades appear on transcript. Impact on CGPA like regular courses.

**Q: Can I skip SEC if workload is high?**
A: No. All 5 SEC courses are MANDATORY. No exemptions.

**Q: Do SEC courses have labs?**
A: Yes, most are hands-on/workshop-based. Some have internal projects.

## General

**Q: What happens if I don't select all my electives?**
A: You must select all required electives. Incomplete electives → incomplete degree.

**Q: Can I audit a course without credit?**
A: Specific audit courses available (separate from PE/OE). Cannot audit regular courses for no credit.

**Q: Is there flexibility in semester progression?**
A: Limited. Semesters I-IV are generally fixed. From Sem V onwards, some flexibility if all prerequisites met.

## CONTACT INFORMATION & RESOURCES

**Important Contacts:**
- **Registrar Office:** For regulations and official queries
- **Department Head:** For course-specific queries
- **Faculty Advisor:** For academic planning
- **Student Services:** For grievances and support

**Official Resources:**
- **University Portal:** www.jntugv.edu.in (assumed)
- **Student Handbook:** Available from admission office
- **Course Descriptions:** Department websites
- **SWAYAM Courses:** https://www.swayam.gov.in

**Key Dates to Remember:**
- Course registration: 1 week before semester
- Add/Drop deadline: End of week 2
- Mid-sem examinations: Weeks 5-6
- Course freeze: Week 12
- Sem-end exams: Week 16-17

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## VERSION HISTORY

| Version | Date | Changes |
|---|---|---|
| R23 | Jan 2024 | Initial release for 2023-24 batch |
| R23 | Jul 2024 | Clarifications on Minor/Honors |
| R23 | Jan 2026 | Current document - Comprehensive Guide |

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## DISCLAIMER

This document is a comprehensive guide based on JNTUGV B.Tech R23 Regulations. For official and binding information, refer to: - University Academic Regulations (Official R23 Document) - Department-specific guidelines - University Registrar's Office

*Document Prepared: January 2026*
*Applicable for Batches: 2023-24 onwards*
*Subject to University Amendment*

# 1. Professional Electives (PE) by Branch

## ECE - Professional Electives

| PE-I | PE-II | PE-III | PE-IV | PE-V |
|---|---|---|---|---|
| Antenna Analysis & Design | Communication Systems | Advanced VLSI Design | Microwave Engineering | RF & Microwave Circuits |
| Computer Architecture & Organization | Digital Signal Processing | Embedded Systems | Wireless Communications | Optical Communications |
| Electronic Measurements & Instrumentation | Information Theory & Error Control Coding | Power Electronics | Satellite Communications | Advanced Signal Processing |
| Control Systems | Image Processing | Neural Networks | Machine Learning | IoT & Wireless Sensor Networks |
| Microelectronics | Electromagnetic Theory | Advanced Microcontrollers | Millimeter Wave Engineering | Network Security |

## EEE - Professional Electives

| PE-I | PE-II | PE-III | PE-IV | PE-V |
|---|---|---|---|---|
| Power System Analysis | HVDC Transmission | Smart Grids | Power Quality | Renewable Energy Integration |
| Electrical Machine Design | Power Electronics | Drives & Control | Advanced Motors | Energy Conversion Systems |
| High Voltage Engineering | Switchgear & Protection | Power System Protection | Fault Analysis | Distribution Systems |

| Electrical Materials | Electromagnetic Field Theory | Advanced Electrical Machines | Superconductivity | Electrical Insulation |
|---|---|---|---|---|
| Power Generation | Hydro Power Systems | Thermal Power Systems | Nuclear Power Systems | Power Plant Operation |

## CSE - Professional Electives

| PE-I | PE-II | PE-III | PE-IV | PE-V |
|---|---|---|---|---|
| Compiler Design | Advanced Database Systems | Cloud Computing | Distributed Systems | Blockchain Technology |
| Cryptography & Network Security | Machine Learning | Deep Learning | Natural Language Processing | Advanced Algorithms |
| Web Technologies | Big Data Analytics | Internet of Things | Mobile Computing | Quantum Computing |
| Software Architecture | DevOps & CI/CD | Advanced Operating Systems | Parallel Computing | Graph Computing |
| Data Science | Advanced AI | Edge Computing | Software Testing | Advanced Networking |

## MECH - Professional Electives

| PE-I | PE-II | PE-III | PE-IV | PE-V |
|---|---|---|---|---|
| Advanced Thermodynamics | Renewable Energy Systems | Thermal Power Plants | Cryogenics | Energy Engineering |
| Advanced Control Systems | Robotics & Automation | Computer-Aided Design | Finite Element Analysis | Manufacturing Systems |
| Computational Fluid Dynamics | Turbomachinery | Aerodynamics | Advanced Vibrations | Acoustics |

| | | | | |
|---|---|---|---|---|
| Advanced Materials | Nanotechnology | Composite Materials | Smart Materials | Materials Selection |
| Advanced Manufacturing | Additive Manufacturing | Precision Engineering | Micro-Machining | Industrial Robotics |

## CSEDS (Electronics & Data Science) - Professional Electives

| PE-I | PE-II | PE-III | PE-IV | PE-V |
|---|---|---|---|---|
| Embedded Systems Design | Real-time Operating Systems | FPGA Design & Implementation | Hardware-Software Codesign | IoT Applications |
| Signal Processing for Data Science | Statistical Machine Learning | Time Series Analysis | Reinforcement Learning | Computer Vision |
| Sensor Networks & IoT | Edge Computing & Fog Systems | 5G Technologies | Cyber-Physical Systems | Digital Signal Processing |
| Advanced Microcontrollers | ARM Architecture & Programming | System-on-Chip Design | Mixed-Signal Design | Power-Aware Computing |
| Data Analytics & Visualization | Big Data Platforms | Stream Processing | Predictive Analytics | Business Intelligence |

# 2. Open Electives (OE) - Common Pool for All Branches

| OE-I | OE-II | OE-III | OE-IV |
|---|---|---|---|
| Economics for Engineers | Indian Constitution | Environmental Sciences | Disaster Management & Sustainability |
| Engineering Ethics & Cyber Ethics | Ethical Hacking & Cybersecurity | Business Management & Entrepreneurship | Artificial Intelligence & Expert Systems |

| Technical Innovation & Tinkering | Design Thinking for Innovation | Emerging Technologies | Advanced Robotics |
|---|---|---|---|
| Value Creation & Innovation | Marketing & Sales | Project Management | Quality Management Systems |
| Artificial Intelligence Basics | Cybersecurity Fundamentals | Environmental Impact Assessment | Social Entrepreneurship |

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# 3. Skill Enhancement Courses (SEC)

## Structure: 5 Total Courses (Sem V-VII)

- **2 Basic Skill Courses** (Semester V-VI)
- **2 Advanced Skill Courses** (Semester VI-VII)
- **1 Soft Skill Course** (Any Semester)

## Examples by Branch

### ECE SEC Courses

- **Basic Skills**: Python Programming, VLSI Design Fundamentals
- **Advanced Skills**: Embedded Systems Development, Signal Processing Applications
- **Soft Skills**: Technical Communication & Presentation

### CSE SEC Courses

- **Basic Skills**: Web Development, Database Management
- **Advanced Skills**: Cloud Technologies, Data Science Applications
- **Soft Skills**: Team Leadership & Collaboration

### MECH SEC Courses

- **Basic Skills**: CAD Modeling, 3D Printing Technology
- **Advanced Skills**: Simulation & Analysis, Advanced Manufacturing
- **Soft Skills**: Workplace Communication

### EEE SEC Courses

- **Basic Skills**: Power System Simulation, PLC Programming

- **Advanced Skills**: Smart Grid Technologies, Energy Management Systems
- **Soft Skills**: Project Management

### CSEDS SEC Courses

- **Basic Skills**: Python for IoT, Embedded C Programming
- **Advanced Skills**: Machine Learning Implementation, Edge Computing
- **Soft Skills**: Cross-functional Team Dynamics

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# 4. Mandatory Courses (MC) - Non-Credit

| Course | Semester | Description |
|---|---|---|
| Environmental Sciences | I-II | Fundamental environmental awareness and conservation |
| Indian Constitution | I-II | Constitutional framework and responsibilities |
| Technical Paper Writing & IPR | III-IV | Research paper writing and intellectual property rights |
| Design Thinking for Innovation | II | Innovation methodologies and problem solving |
| Tinkering Labs / Maker Spaces | II | Hands-on experimentation and prototyping |

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# 5. Audit Courses (AC) - Non-Credit

| Course | Description |
|---|---|
| Physical Fitness & Wellness | Sports, yoga, and fitness activities |
| Creative Arts | Visual arts, music, performing arts, creative writing |
| Universal Human Values | Ethics, integrity, social responsibility |
| Literary & Proficiency | Language proficiency, literary appreciation |
| Lectures by Eminent People | Guest lectures from industry and academia |
| NSS/Scouts & Guides | Community service and volunteer activities |

| Student Induction Program | 3-week orientation covering all audit courses |
|---|---|

# 6. Year-wise Distribution of Electives

| Year | Semester | Course Type | Credits | Details |
|---|---|---|---|---|
| **I** | I | Foundation Courses | 13 | Humanities, Basic Sciences, Engineering Sciences |
| | II | Foundation Courses | - | Continued |
| **II** | III | Core + SEC (Basic Skill) | 20+ | First Skill Enhancement Course |
| | IV | Core + SEC (Basic Skill) | - | Second Skill Enhancement Course + OE-I |
| **III** | V | Core + PE-I + OE-II | 15-20 | Professional Electives begin |
| | VI | Core + PE-II + SEC (Advanced) | 15-20 | Advanced Skill Course |
| **IV** | VII | PE-III + PE-IV + OE-III + SEC (Soft) | 15-20 | Final semester courses + Soft Skill |
| | VIII | PE-V + OE-IV + Internship & Project | 8-10 | Full Internship + Major Project (200 marks) |

# 7. Credits Summary

| Category | Credits | Percentage | Details |
|---|---|---|---|
| Humanities & Management (HM) | 13 | 8% | Foundation courses |
| Basic Sciences (BS) | 20 | 13% | Physics, Chemistry, Mathematics |
| Engineering Sciences (ES) | 23.5 | 14% | Core engineering fundamentals |
| Professional Core (PC) | 54.5 | 34% | Discipline-specific core courses |

| Electives & Skills (PE+OE+SEC) | 33 | 21% | Professional (15 cr) + Open (12 cr) + Skill (6 cr) |
|---|---|---|---|
| Internships & Projects (PR) | 16 | 10% | Summer + Full Semester Internship + Project |
| **Total** | **160** | **100%** | 4-year B.Tech Program |

# 8. Important Guidelines

## Elective Selection Rules

1. **Professional Electives (PE)**: Must select from parent branch specialization
2. **Open Electives (OE)**: Can select from interdisciplinary common pool
3. **Skill Enhancement (SEC)**: 2 Basic + 2 Advanced + 1 Soft skill courses
4. **No Duplicate Content**: Cannot take courses with similar syllabus content
5. **Prerequisites**: Must complete prerequisite courses before enrolling

## Internship Requirements

- **Summer Internship (End of Year II)**: 8+ weeks, community-oriented
- **Summer Internship (End of Year III)**: 8+ weeks, industry-oriented
- **Final Semester**: Full-time industry internship with project work
- **Evaluation**: 50 marks (Summer) + 200 marks (Full Semester + Project)

## Honors Program (Optional, +15 Credits)

- Additional 15 credits on top of 160-credit B.Tech requirement
- Must have good academic record
- Completed simultaneously with B.Tech program
- Typically includes: Advanced PE courses + Research Project + Thesis

## Minor Degree Option

- Complete 30+ credits from a different specialization
- Use Open Electives and additional PE courses
- Awarded alongside B.Tech degree

# 9. Course Registration Timeline

| Semester | Registration Period | Course Selection |
|---|---|---|
| I | Before First Year | Foundation courses (Pre-assigned) |
| II | End of Sem I | Mostly core + First OE option |
| III | End of Sem II | First PE + Second OE selection |
| IV | End of Sem III | Second PE + Skill courses |
| V | End of Sem IV | Third PE + Third OE selection |
| VI | End of Sem V | Fourth PE + Advanced Skills |
| VII | End of Sem VI | Fifth PE + Fourth OE + Soft Skills |
| VIII | End of Sem VII | Full Internship + Project (No new courses) |

# Notes

- **PE Courses (15 cr)**: 5 professional electives × 3 credits each
- **OE Courses (12 cr)**: 4 open electives × 3 credits each
- **SEC Courses (6 cr)**: 2 basic (3 cr) + 2 advanced (3 cr) - Soft skill as audit
- **MC/AC Courses**: Non-credit mandatory audit courses
- **Total Electives**: 33 credits = 20.6% of 160-credit program

All branches follow identical credit distribution; variations exist only in specific PE course content matching branch specialization.