INSTITUTE OF AERONAUTICAL ENGINEERING
(AUTONOMOUS)
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HIGH-IMPACT PRACTICES FOR STUDENT SUCCESS

High-impact practices (HIPs) *are designed for students to deepen their learning experience, prepare them for advanced roles in engineering, and enhance their ability to contribute meaningfully to their fields. These practices can significantly boost placement prospects for engineering students by making them more competitive, versatile, and attractive to potential employers. HIPs integrate knowledge, critical thinking, and hands-on complex problem-solving, creating a well-rounded educational foundation. Here are some key high-impact practices that benefit engineering students:*

1. **Projects**
2. **Creative Assignments**
3. **ePortfolios**
4. **Internships**
5. **Journal Articles / Conference Papers**
6. **Certifications**
7. **Participation in Activities / Events**

1. PROJECTS

Engineering combines both theoretical and practical knowledge in a complex way. Projects serve as the crucial link between these two aspects, providing the essential balance needed in the corporate world.

1. **SRI** (Summer Research Internship) Project
2. **VIP** (Vertically Integrated Projects)
3. **SP** (Side Project)
4. **SE** (Software Engineering / Software Design) Projects
5. **MCE** (Multi-disciplinary Community Engaged) Projects
6. **ML** (Machine Learning) Projects
7. **FSI** (Full Semester Internship) Project / Capstone Project

1.1 Summer Research Internship Project

A **Summer Research Internship (SRI)** Project is an opportunity for students, to gain in-depth, hands-on research experience during the summer break. The primary purpose of an SRI project is to expose students to the research process, enhance their technical skills, and develop their problem-solving abilities within a structured, intensive period.

Mentor	Semester	Team Size	Duration	Project Outcome
Faculty Mentor and Super Mentor	III / V	Individual	3 to 4 Weeks	Journal Article / Patent / Conference Paper

SRI Project - Program Coordinator:	
	**Dr. K Rajendra Prasad** Professor and Head, CSE (DS) Email: dr.rajendraprasad@iare.ac.in Phone: 9618614555

1.2 VIP Project

Vertically Integrated Projects (VIP) involve design/discovery efforts involving students, researchers and faculty in their areas of expertise. VIP projects ambitious and long-term. Working together productively in a diverse team to find creative solutions to the problems or to make progress on a project is a key employability skill in the 21st century.

VIP teams are:

- **Multidisciplinary** – drawing students from all disciplines on campus.
- **Vertically integrated –** a mix of B.Tech students starting from III semester, M.Tech students and Ph.D research scholars.
- **Long Term –** each student may participate in a project for up to two / three years.

It allow students to gain unique, real-world experience that enhances their CVs, learn skills associated with interdisciplinary and multidisciplinary group work, and emerge with an increased awareness of global problems and their role in tackling them, making them more engaged and informed global citizens.

The continuity, technical depth, and disciplinary breadth of these teams are intended to:

- Learn and practice diverse skill-sets, make substantial technical contributions to the team project(s), and experience many different roles on a large, multidisciplinary design/discovery team.
- Enable the completion of large-scale design/discovery projects that are of significant benefit to faculty members' research programs.

Mentor	Semester	Team Size	Duration	Project Outcome
Faculty Mentor	II	Up to 3 Members	1 Year	Journal Article / Patent / Conference Paper

VIP Project - Program Coordinator:	
	**Dr. V V S Harnadh Prasad** Professor in ME, Dean of Competency Building & Consultancy Email: vvshprasad@iare.ac.in Phone: 9985821449

1.3 Side Projects

A **Side Project (SP)** is an independent project that a student work on outside of your primary responsibilities. Side projects are often started to explore personal interests, build skills, or work on something creatively fulfilling without the constraints of routine academic settings. These projects provide an opportunity for hands-on learning, creativity, and personal growth, and they often become valuable additions to a portfolio or resume. It covers multiple areas of technologies from hardware to software and client side apps to backend cloud services.

Mentor	Semester	Team Size	Duration	Project Outcome
Faculty Mentor	III	Individual	1 Semester	Skill enhancement, Portfolio Building, Career Advancement

SP Project - Program Coordinator:	
	**Dr. C V Rama Padmaja** Associate Professor in CSE and Trainer, Career Development Centre Email: cvrpadmaja@iare.ac.in Phone: 9989346633

1.4 Software Engineering Project

The **software engineering project (SEP)** allow the students to apply engineering principles, design practices, and technical skills to create well-structured, functional, and reliable software solutions. These projects are valuable in both academic and professional contexts, as they develop competencies needed for real-world software development.

Mentor	Semester	Team Size	Duration	Project Outcome
Faculty Mentor	IV	Up to 2 Members	1 Semester	In-depth understanding of Software Development life Cycle (SDLC) process

SEP Project - Program Coordinator:	
	**Dr. B Padmaja** Associate Professor and Dean, Career Development Centre Email: b.padmaja@iare.ac.in Phone: 9618150625

1.5 Multi-disciplinary Community Engaged Project

Multi-disciplinary Community Engaged (MCE) project allows students to create impactful, collaborative initiatives that address community challenges through the combined expertise of diverse academic disciplines. These projects not only benefit the community but also enhance the educational experience of students, fostering their development as informed, responsible citizens.

Mentor	Semester	Team Size	Duration	Project Outcome
Faculty Mentor	IV	Up to 3 Members	1 Year	Empowering students to make an impact on communities while gaining technical expertise

MCE Project - Program Coordinator:

Dr. J Suresh Goud
Assistant Professor in Mathematics and Dean of Student Services
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1.6 Machine Learning Project

Machine Learning (ML) projects allow students to apply the mathematical and statistical knowledge as well as principles of algorithms and data structures to solve real-world problems. ML project develops a range of skills, from data preprocessing and feature engineering to model building, evaluation, and tuning. These projects help students to understand how machine learning can be applied to various fields, such as healthcare, finance, and robotics. It involve working with large datasets, complex models, and intricate problem-solving processes. These projects often involve using modern libraries, frameworks, and technologies, such as TensorFlow, Keras, Matplotlib, PyTorch, and Scikit-learn.

Mentor	Semester	Team Size	Duration	Project Outcome
Faculty Mentor	V	Up to 2 Members	1 Year	Journal Article / Conference Paper

ML Project - Program Coordinator:

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1.7 Full Semester Internship / Capstone Project

1. Full Semester Internship

Full Semester Internship (FSI) project allow students to spend one full semester in an identified industry, R&D organization or another academic institution / University and has to carry out the internship as per the guidelines of that industry or institute. The FSI work shall be innovative in nature and explore the research bent of the mind of the student. These projects help bridge the gap between academia and industry, giving students a practical portfolio piece that prepares them for their future careers.

Mentor	Semester	Team Size	Duration	Project Outcome
Faculty Mentor and Industry Mentor	VII / VIII	Individual	1 Semester	Journal Article / Patent / Conference Paper

2. Capstone Project

A Capstone project allow students to apply their theoretical knowledge to solve real-world problems, enhancing critical thinking, teamwork, and project management skills. These projects involve a variety of tasks, such as designing, building, and testing solutions.

Mentor	Semester	Team Size	Duration	Project Outcome
Faculty Mentor	V / VI	Up to 3 Members	1 Year	Journal Article / Patent / Conference Paper

FSI / Capstone Project - Program Coordinator:	
	**Dr. V Padmanabha Reddy** Professor in ECE and Dean of Planning, Monitoring & Continuing Studies Email: v.padmanabhareddy@iare.ac.in Phone: 9490244578

2. CREATIVE ASSIGNMENTS

Creative assignments (CA) encourage students to think in innovative ways as they demonstrate their learning. Thinking creatively involves combining or synthesizing information or course materials in new ways and is characterized by "**a high degree of innovation, divergent thinking, and risk-taking**". It is associated with imagination and originality, and additional characteristics include: being open to new ideas and perspectives, believing alternatives exist, withholding judgment, generating multiple approaches to problems, and trying new ways to generate ideas. Creative thinking is considered an important skill alongside critical thinking in tackling contemporary problems. **Critical thinking allows students to evaluate the information presented to them while creative thinking is a process that allows students to generate new ideas and innovate.**

The benefits of creative assignments include:

- Improved student engagement, motivation, and satisfaction and beyond learning of course content.
- Promotes innovation, academic integrity, student self-awareness / metacognition

CA - Program Coordinator:	
	**Dr. G Chandra Sekhar** Assistant Professor in CSE and Dean of Academics Email: g.chandrasekhar@iare.ac.in Phone: 9703618749

3. E-PORTFOLIOS

An e-Portfolio is a visual representation of design and engineering skills presented through a collection of engineering projects, technical concepts and skills developed. Students can use an e-portfolio in order to build employability skills: by presenting and showcasing accomplishments and expertise to potential employers, facilitating reflection on career aspirations or preparing for job interviews. E-Portfolios can be a very effective way for students to market their talent to potential employers.

Contents in an e-Portfolio

- Career goals and objectives
- Projects
- Personal website (if any)
- GitHub repository and LinkedIn Profile
- Skill Sets: Programming Languages and Technologies
- Internships
- Coding Profile Scores and Ratings
- Current Resume
- Journal Article / Conference papers (if any)
- Certificates, Awards, or Digital badges (if any)
- Organizations and activities

Websites to create e-portfolios

- www.weebly.com
- www.wordpress.com
- www.squarespace.com
- www.foliospaces.org
- www.wix.com
- www.sites.google.com
- www.canva.com
- www.portfoliobox.net

Example: https://www.cs.colostate.edu/~ebmartin/portfolio/root/

e-Portfolio Program Coordinator:	
	**Dr. M Pala Prasad Reddy** Associate Professor in IT and Placement and Training Officer Email: p.prasadreddy@iare.ac.in Phone: 9491602701

4. INTERNSHIPS

Internships are short periods of professional experience. These are generally shorter typically lasts between one and four months, but the exact duration depends on the organization involved. Most internship opportunities advertised by multinational organisations are aimed at pre-final year students.

Student Interns Expect

- To gain real work experience and provide meaningful assistance to the company.
- To gain experience and skills in a particular field.
- To develop professional contacts.
- To gain exposure to upper management.
- To receive an orientation to the company.

Types of Internships:

- **Paid internships** – Students do these internships usually during their second / third year of engineering.
- **Unpaid internships** – Students do these internships as volunteer positions through non-profit organizations and think tanks.
- **Partial paid internships** – Students are paid in the form of a stipend. Stipends are typically a fixed amount of money that is paid out on a regular basis.
- **Virtual internships** – Students do internships remotely on email, phone, and web communication.
- **International internships** – Students do internships in a country other than their country of residence.

Internships - Program Coordinator:	
	**Dr. P L Srinivasa Murthy** Professor in CSE and Dean of Industry Institute Interface Email: dean-iiic@iare.ac.in Phone: 9989885556

5. PUBLICATIONS - JOURNAL ARTICLES / CONFERENCE PAPERS

Publishing articles or conference papers is an important aspect of academic and professional development for engineering graduates. Engaging in this scholarly activity offers several benefits that can enhance their careers and contribute to their fields. It is vital for engineering graduates as it enhances their professional development and academic credentials. It enables them to contribute to their fields, gain recognition, and establish networks that can facilitate career growth. The skills acquired through the publication process are invaluable in both academic and professional contexts, making publishing a crucial component of an engineering graduate's journey.

Types of Domains

- Machine Learning and Artificial Intelligence
- Cybersecurity
- Internet of Things (IoT)
- Blockchain
- Computer Vision
- Cloud Computing
- Robotics and Autonomous Systems
- Natural Language Processing (NLP)
- Human Computer Interface (HCI)
- Quantum Computing
- Software Engineering
- Networking and Communications
- Virtual Reality and Augmented Reality

Publications - Program Coordinator:	
	**Dr. G Ranjith Kumar** Associate Professor in CSE (DS), Dean of Research and Development Email: g.ranjith@iare.ac.in Phone: 9440044208

6. CERTIFICATIONS

Certifications are crucial for engineering graduates as they enhance employability, validate skills, and demonstrate a commitment to professional development. They open doors to career advancement, increase earning potential, and provide networking opportunities, making them an essential component of a successful engineering career. Certifications serve as proof that graduates possess the specific skills and knowledge required in their field. This validation can increase credibility with potential employers and clients.

Software Development and Programming Certifications

- Certified Java Programmer (Oracle Certified Associate / Professional)
- Python for Everybody Specialization
- C++ Certified Associate Programmer (CPA)

Cyber Security Certifications

- Certified Information Systems Security Professional (CISSP)
- Certified Ethical Hacker (CEH)
- CompTIA Security+

Data Science and Machine Learning

- Google Data Analytics Professional Certificate
- Machine Learning Certification
- Certified Data Scientist (CDS)

Cloud Computing

- AWS Certified Solutions Architect – Associate
- Microsoft Certified: Azure Fundamentals
- Google Associate Cloud Engineer

Networking

- Cisco Certified Network Associate (CCNA)
- CompTIA Network+
- Juniper Networks Certified Associate – Junos (JNCIA – Junos)

Database Management

- Oracle Database SQL Certified Associate
- Microsoft Certified: Azure Data Fundamentals
- MongoDB Certified Developer Associate

DevOps and Automation

- Docker Certified Associate (DCA)
- Certified Kubernetes Administrator (CKA)
- Microsoft Certified: DevOps Engineer Expert

Artificial Intelligence and Deep Learning

- Deep Learning Specialization
- Microsoft Certified: AI-900 Azure AI Fundamentals
- TensorFlow Developer Certificate

Web Development

- Front-End Web Developer Certificate
- Certified Web Professional – Web Developer (CWP)
- Responsive Web Design Certification

Project Management

- Certified ScrumMaster (CSM)
- Project Management Professional (PMP)
- Agile Certified Practitioner (PMI-ACP)

Certifications - Program Coordinator:	
	**Dr. V V S Harnadh Prasad** Professor in ME, Dean of Competency Building & Consultancy Email: vvshprasad@iare.ac.in Phone: 9985821449

7. PARTICIPATION IN ACTIVITIES / EVENTS

Participation in activities and events (PAE) is essential for engineering graduates as it complements their academic experience, fosters professional growth, and enhances personal development. Engaging in such activities provides numerous benefits that can positively impact their careers. Activities and events often focus on developing both technical and soft skills, including teamwork, leadership, communication, problem-solving, and project management.

Types of Activities and Events

- Workshops and Seminars
- Conferences and Symposia
- Hackathons and Competitions
- Community Service and Outreach
- Student Leadership Activities
- Field Trips
- Online Courses and Webinars

PAE - Program Coordinator:	
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USE OF MODERN ENGINEERING TOOLS AND TECHNOLOGIES FOR PROJECTS

Domain: AI / ML / DL

Programming Languages	**Types of Languages**			
	• Python • R • Java • Julia • Scala • JavaScript			
Frontend Technologies	**Core Web Development**	**Frontend Frameworks and Libraries**	**Data Visualization**	**Desktop and Mobile Applications**
	• HTML5 • CSS3 • JavaScript	• React.js • Vue.js • Angular • Svelte • TensorFlow.js	• D3.js • Plotly.js • Chart.js • Three.js	• React Native • Flutter • Electron
Backend Technologies	**Core Backend Languages**	**Backend Frameworks**	**API Development**	
	• Python • Node.js • Go • Java	• Flask • Django • FastAPI • Express.js • Spring Boot	• REST APIs • GraphQL gRPC	
Frameworks and Libraries	**ML Frameworks and Libraries**	**DL Frameworks**	**NLP Libraries**	**Computer Vision Libraries**
	• Scikit-learn • XGBoost • LightGBM • CatBoost	• TensorFlow • Keras • PyTorch • MXNet • Theano • Caffe	• Transformers by Hugging Face • SpaCy • NLTK • Gensim	• OpenCV • Detectron2 • YOLO
AI / ML / DL Models	**Classification Models**	**Object Detection and Segmentation Models**	**NLP Models**	**Reinforcement Learning Models**
	• CNNs • ResNet • MobileNet V3 • AlexNet • VGG16 • LeNet	• YOLO • Faster R-CNN • Mask R-CNN • SSD • RetinaNet • DETR • EfficientDet	• BERT • GPT • T5 • RoBERTa, ALBERT, DistilBERT	• DQN • PPO • SARSA • TRPO • AlphaZero • Dyna-Q
Cloud Platforms	**Cloud Platforms**		**AI Specific Cloud Services**	
	• AWS • GCP		• Google AutoML • AWS SageMaker	

	• Microsoft Azure • IBM Cloud		• Azure Cognitive Services	
DevOps and MLOps Tools	**Version Control**	**CI / CD Tools**	**Containerization and Orchestration**	**Infrastructure as Code (IaC)**
	• Git • GitHub • GitLab	• Jenkins • GitLab CI • CircleCI	• Docker • Kubernetes	• Terraform **Monitoring and Logging** • Prometheus & Grafana • ELK Stack

DOMAIN: JAVA FULL STACK

Programming Languages	**Types of Languages**			
	• Java • JavaScript • TypeScript • SQL • HTML5 & CSS3 • Python • Kotlin			
Frontend Technologies	**Core Frontend Technologies**	**Frontend Frameworks and Libraries**	**State Management**	**Front-End Tools**
	• HTML5 • CSS3 • JavaScript • TypeScript	• React.js • Angular • Vue.js • Bootstrap / Tailwind CSS	• Redu • NgRx	• Webpack • Babel
Backend Technologies	**Core Backend Technology**	**Backend Frameworks**	**API Development**	**Database Connectivity**
	• Java	• Spring Boot • Spring MVC • Java EE • Micronaut • Hibernate	• RESTful APIs • GraphQL • Jersey	• JPA • JDBC • MyBatis
Databases	**Relational Databases**	**NoSQL Databases**	**Graph Databases**	
	• MySQL • PostgreSQL • Oracle Database • MariaDB	• MongoDB • Cassandra • Redis	Neo4j	
Frameworks and Libraries	**Java Frameworks**		**Utility Libraries**	
	• Spring Boot • Hibernate JPA		• Apache Commons • Lombok Guava	
ML based Full-Stack Projects (Optional)	**Libraries**		**Machine Learning Platform**	
	• Deep Java Library		• H2O.ai	

<table>
<tr><td></td><td colspan="2">• Java-ML
• Weka
• Deeplearning4j
TensorFlow Java</td><td colspan="2"></td></tr>
<tr><td rowspan="2">Cloud Services</td><td colspan="2">Cloud Platforms</td><td colspan="2">Database-as-a-Service</td></tr>
<tr><td colspan="2">• AWS
• GCP
• Microsoft Azure
Heroku</td><td colspan="2">• Amazon RDS
• MongoDB Atlas
• Google Cloud
Firestore</td></tr>
<tr><td rowspan="4">DevOps Tools</td><td>Version Control</td><td>Containerization</td><td>Monitoring and Logging</td><td>Security</td></tr>
<tr><td>• Git</td><td>• Docker
• Kubernetes</td><td>• Prometheus
• Grafana
• ELK Stack</td><td>• OAuth 2.0 / JWT
• Spring Security</td></tr>
<tr><td colspan="2">CI / CD Tools</td><td colspan="2">Infrastructure as Code (IaC)</td></tr>
<tr><td colspan="2">• Jenkins
• GitLab CI
• Travis CL
CircleCI</td><td colspan="2">• Terraform
Ansible</td></tr>
</table>

DOMAIN: CYBER SECURITY

Programming Languages	**Types of Languages**	
	• Python • C and C++ • JavaScript • Ruby • PowerShell • SQL	
Penetration Testing and Vulnerability Scanning Tools	**Penetration Testing tools**	**Vulnerability Scanning Tools**
	• Metasploit • Nmap • Burp Suite • OWASP ZAP • Nikto • Wireshark • Aircrack-ng • Hydra • John the Ripper • SQLmap	• Nessus • OpenVAS • QualysGuard • Nmap • Nikto • Burp Suite • OWASP ZAP • MBSA • Retina Network Security Scanner • Acunetix
Network Security and Traffic Analysis Tools	**Network Security Tools**	**Traffic Analysis Tools**
	• Snort • pfSense • Suricata	• Zeek • Wireshark • Tcpdump
Reverse Engineering and Malware Analysis Tools	**Reverse Engineering Tools**	**Malware Analysis Tools**
	• Ghidra • IDA Pro • Radare2	• YARA • Cuckoo Sandbox • PEiD

	• OllyDbg • Frida • X64dbg		• REMnux • Sysinternals Suite • Malwarebytes	
Cryptography Tools	**Encryption Tools**	**Hashing Tools**	**PKI and Certificate Management Tools**	**Steganography Tools**
	• VeraCrypt • GnuPG • BitLocker	• HashCalc • MD5 & SHA Checksum Utility • CertUtil	• OpenSSL • XCA • KeyStore Explorer	• Steghide • OpenPuff • SilentEye
Digital Forensics and Incident Response Tools	**Digital Forensics Tools**		**Incident Response Tools**	
	• Autopsy • FTK Imager • The Sleuth Kit • Xplico • EnCase Forensic • X1 Social Discovery • Oxygen Forensic Detective • Magnet AXIOM • Bulk AXIOM • Bulk Extractor		• Volatility • SIFT Workstation • Cortex XDR • Mandiant Redline • GRR Rapid Response • Sysinternals Suite • CrowdStrike Falcon • Carbon Black Response	
SIEM (Security Information and Event Management) and Log Management Tools	**SIEM (Security Information and Event Management) Tools**		**Log Management Tools**	
	• Splunk • QRadar • AlienVault OSSIM • LogRhythm • SolarWinds SIEM • Sumo Logic • Enterprise Security Manager • ArcSight		• Graylog • ELK Stack • Papertrail • Loggly • Sumo Logic • Fluentd • Graylog • Datadog	
Cloud Security Tools	**Cloud Security Posture Management (CSPM) Tools**		**Cloud Security Monitoring Tools**	
	• AWS Security Hub • Azure Security Centre • Google Cloud Security Command Center • CloudSploit		• Prisma Cloud • Trend Micro Cloud One • CLoudHealth by VMware • Sumo Logic SIEM • MVISION Cloud	
DevSecOps Tools	**Container Security Tools**		**Kubernetes Security & Runtime Monitoring Tools**	
	• Clair • Anchore • Aqua Security • Sysdig Secure		• Falco • Kube-bench	
Machine Learning and Data Analysis Tools	**Machine Learning Frameworks**		**Data Analysis & Visualization Tools**	
	• TensorFlow • PyTorch		• Pandas • Numpy	

	• Scikit-Learn • Keras • XGBoost • LightGBM • CatBoost • Caffe • MXNet • H2O.ai	• ELK Stack • D3.js • Matplotlib • Seaborn • Plotly • Bokeh • Apache Superset • Tableau • Google Data Studio • Power BI • Qlik Sense
Identity and Access Management (IAM) Tools	**Identity Management Tools**	**Access Management Tools**
	• Okta • Azure AD • Ping Identity • OneLogin • Auth0	• AWS Identity and Access Management (IAM) • CyberArk • SailPoint Identity IQ • BeyondTrust • RSA SecurID
Containerization and Virtualization Tools	**Containerization Tools**	**Virtualization Tools**
	• Docker • Kubernetes • Podman • OpenShift • Rancher • Docker Compose • Containerd • Helm	• VirtualBox • VMware • Hyper-V • Xen • KVM • Proxmox VE • Virtuozzo • QEMU
Threat Intelligence Platforms	**Commercial Threat Intelligence Platforms**	**Open-Source Threat Intelligence Platforms**
	• ThreatConnect • Recorded Future • Anomali • IntSights • ThreatQuotient • CrowdStrike Falcon X	• MISP • AlienVault OTX • OpenDXL • TheHive • Yeti