

**ACADEMIC AFFAIRS OFFICE
INDIAN INSTITUTE OF TECHNOLOGY ROORKEE**

No. Acd./1285 /IAPC-98

Dated: March 17, 2021

Head, Department of Computer Science & Engg.

The IAPC in its 98th meeting held on 03.02.2021 vide Item No. 98.2.5 considered the proposal of Department of Computer Science and Engineering to introduce following PECs:

1. CSN-527: Internet of Things
2. CSN-528: Natural Language Processing

The IAPC recommended the proposal with minor modifications. Duly modified syllabi is attached as **Appendix-A**.



Assistant Registrar (Curriculum)

Encl: as above

Copy to (through e mail):-

1. All faculty
2. All Heads of Departments/ Centres
3. Dean, Academic Affairs
4. Associate Dean of Academic Affairs (Curriculum)
5. Channel I/ Academic webpage of iitr.ac.in/ acad portal

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: Department of Computer Science and Engineering

1. **Subject Code:** CSN-527 **Course Title:** Internet of Things
2. **Contact Hours:** **L:** 3 **T:** 1 **P:** 0
3. **Examination Duration (Hrs.):** **Theory:** 3 **Practical:** 0
4. **Relative Weightage:** **CWS:** 20-35 **PRS:** 0 **MTE:** 20-30 **ETE:** 40-50 **PRE:** 0
5. **Credits:** 4 **6. Semester:** Both **7. Subject Area:** PEC
8. **Pre-requisite:** Knowledge of computer networks
9. **Objective:** To impart the know-how of Internet of Things and their applications, architectures and protocols, building IoT applications/systems, securing the IoT systems, and their recent advances.

10. Details of the Course

S.No.	Contents	Contact hours
1.	Basic concepts revisited: Introduction to sensing & actuating, Basic networking, Wireless networks, Wireless sensor networks (WSN), Communication protocols, and other enabling technologies, IoT standards, Data storage & management issues and approaches, Cloud computing, Key challenges, research, and future directions of IoT, and security & privacy issues.	7
2.	Embedded Systems: Hardware and software of IoT, Microcontrollers, Understanding and programming Arduino, Raspberry Pi, NodeMCU, Lora, etc. Integrating microcontrollers with sensors and actuators, Building the IoT applications with any microcontroller.	6
3.	IoT Architectures and Protocols: Layers of communication, Architectures: State-of-the-art, IoT architecture reference models, Different views of IoT architectures and frameworks design, Protocols: Application protocols, Service discovery protocols, Infrastructure protocols, and other protocols. Understanding various types of protocols like HTTP, MQTT, CoAP, AMQP, 6LoWPAN, etc. Cross-layer implementations, and Data dissemination.	9
4.	Support Technologies for IoT: Big Data, Data Analytics, Artificial Intelligence, Mobile, Cloud, Software defined networks, 5G, and Fog/Edge computing. IoT integration with recent technologies. State-of-the-art. Design goals, challenges, and components.	8
5.	Cyber Physical Systems: Industry 4.0, Society 5.0, Design & use cases, Development, and implementation insights some examples like smart cities, smart homes, smart grids, smart agriculture, smart healthcare, smart transportation, smart manufacturing, and other smart systems. State-of-the-art. Conceptualizing the new IoT-based smart systems using a case study.	6
6.	IoT Security & Privacy: –, IoT Security and Privacy issues and challenges, Risks involved with IoT infrastructures, Trust in IoT platforms and other integrating technologies, Data aggregation, storage, retrieval, and other management issues including fault tolerance, interoperability, security, and privacy, Cyber-physical-systems and their security and privacy, Mitigation approaches.	6
Total		42

11. Suggested Books:

S.No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1.	Edited by: Buyya, Rajkumar, and Amir Vahid Dastjerdi, Internet of Things: Principles and paradigms. Elsevier/Morgan Kaufmann	2016
2.	Bahga, Arshdeep; Madiseti, Vijay, Internet of Things (A Hands-on-Approach), AbeBooks.com	2014
3.	Sohraby, Kazem, Daniel Minoli, and Taieb Znati. Wireless sensor networks: technology, protocols, and applications. John Wiley & Sons	2007
4.	Marinescu, Dan C., Cloud computing: theory and practice. Elsevier/ Morgan Kaufmann	2017

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: Department of Computer Science and Engineering

1. **Subject Code:** CSN-528 **Course Title:** Natural Language Processing
2. **Contact Hours:** **L:** 3 **T:** 1 **P:** 0
3. **Examination Duration (Hrs.):** **Theory:** 3 **Practical:** 0
4. **Relative Weightage:** **CWS:** 20-35 **PRS:** 0 **MTE:** 20-30 **ETE:** 40-50 **PRE:** 0
5. **Credits:** 4 **6. Semester:** Both **7. Subject Area:** PEC
8. **Pre-requisite:** Basic knowledge of Artificial Intelligence
9. **Objective:** To provide an understanding of the theoretical concepts of Natural Language Processing and prepare students for research or industry application of Natural Language Processing.

10. Details of the Course

S.No.	Contents	Contact hours
1.	Introduction to NLP, Corpus, Representation of Words, Preprocessing, Linguistic and Statistical Properties of Words, POS Tagging, Parsing, Performance Measures, Error Analysis, Confusion Matrix	6
2.	Probability and NLP, n-Gram, Language Model, Joint and Conditional Probability, Chain Rule, Markov Assumption, Data Sparsity, Smoothing Techniques, Generative Models, Naive Bayes	6
3.	Distributed representation of words for NLP, Co-occurrence Matrix, Collocations, Dimensionality Reduction, Singular Value Decomposition	6
4.	Document Similarity, Inverted Index, Word2Vec, C-BoW, Skip-Gram Model, Sampling, Hierarchical Soft-max, Sequence Learning	6
5.	Neural Networks for NLP, Multi-Layer Perceptron, Activation Function, Gradient Descent, Sequence Modeling, Recurrent Neural Networks	6
6.	Gated Recurrent Unit, Long-Short Term Memory Networks, 1-D Convolutional Layer, Language Model using RNN, Forward Pass, Backward Pass	6
7.	Applications of NLP, Topic Modeling, Sentiment Analysis, Query Processing, Chat Bot, Machine Translation, Statistical Machine Translation, Neural Machine Translation, Spell Checker, Summarization	6
Total		42

11. Suggested Books:

S.No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1.	Manning, Christopher, and Hinrich Schütze. Foundations of statistical natural language processing. MIT press, 1999.	1999
2.	Jurafsky, Dan. Speech & language processing. Pearson Education India, 2000.	2000
3.	Smith, Noah A. Linguistic structure prediction. Morgan and Claypool, 2011.	2011
4.	Kennedy, Graeme. An introduction to corpus linguistics. Routledge, 2014.	2014