DEPARTMENT OF INFORMATION TECHNOLOGY

B. Tech in Information Technology

As Per NEP 2020

(Version 1)

Scheme of Instruction

&

Syllabus

Final Year

From AY. 2025-26

GAIKWAD-PATIL
GROUP OF INSTITUTIONS

Vision Mission of Institution

Vision - To emerge as a learning Center of Excellence in the National Ethos in domains of Science, Technology and Management.

Mission -

- To strive for rearing standard and stature of the students by practicing high standards of Professional ethics, transparency and accountability.
- To provide facilities and services to meet the challenges of Industry and Society.
- To facilitate socially responsive research, innovation and entrepreneurship.
- To ascertain holistic development of the students and staff members by inculcating Knowledge and profession as work practices.

Vision Mission of Department

Vision - To emerge as a learning hub and centre of excellence in the domain of Information Technology

Mission -

- To impart quality technical education through effective teaching learning process.
- To provide a platform to address societal issues as well as challenges faced by IT industries.
- To foster a culture of research and impart innovative and entrepreneurial skills in the field of IT.
- To ensure overall development of students and staff by inculcating knowledge and professional ethics as a part of lifelong learning.

Program Specific Outcomes

PSO1: Develop and apply logical and programing skills to solve real-world challenges.

PSO2: Utilize knowledge of software engineering and network techniques to design and implement efficient solutions.

PSO3: Leverage computing knowledge to conduct research and adopt emerging technologies in the development of IT systems.

Program Educational Outcomes

PEO 1: Demonstrate essential technical skills to identify, analyze and solve problems and design issues in IT Sector.

PEO 2: Apply field knowledge, research and professional practices to meet the requirements of industries.

PEO3:Imbibe lifelong learning practices and entrepreneurship skills in tune with emerging technologies.

PEO 4: Inculcate professional ethics and managerial skills to satisfy real life problems for serving the needs of society and environment.

Tulsiramji Gaikwad-Patil College of Engineering &Technology, Nagpur

(An Autonomous Institution Affiliated to RTM Nagpur University, Nagpur)

SCHEME OF INSTRUCTION & SYLLABI

Programme: B. Tech. in Information Technology

Scheme of Instructions: B. Tech. Information Technology (As Per NEP 2020)

Semester- VII

Sr	Sem	Type	BoS/ Dept	Sub Code	Subject	T/P	Contact Hours			Credits	% Weightage			ESE Duration	Total Marks
							L	P	Hrs		CT/IA	CA	ESE		
1	VII	PCC	IT	BIT34701	Cryptography and Information Security	T	3	-	3	3	30	10	60	3 Hrs	**100**
2		PCC	IT	BIT34702	Cryptography and Information Security lab	P	-	2	2	1	-	25	25	2 Hrs	**50**
3		PCC	IT	BIT34703	Software Testing & Quality Assurance	T	4	-	3	4	30	10	60	3 Hrs	**100**
4		PEC	IT	BIT34704-06	Program Elective-IV *	T	3	-	3	3	30	10	60	3 Hrs	**100**
5		PEC	IT	BIT34707-09	Program Elective-V*	T	3	-	3	3	30	10	60	3 Hrs	**100**
6		MDM	ECE	BEC34710	Embedded Systems and Interfacing	T	4	-	4	4	30	10	60	3 Hrs	**100**
7		PRO	IT	BIT34710	Project	P	-	8	8	4	-	75	75	-	**150**
8		PCC	CE	BCE4804	Sustainability Development Goals	T	2	-	2	2	14	06	30	2 Hrs	**50**
Total							**19**	**10**	**28**	**24**	**164**	**156**	**430**	**19 Hrs**	**750**

Course Category	BSC/ ESC (Basic Science Course/ Engineering Science Course.)	PCC/PEC (Programme Core courses	VSEC (Skill Course)	Multidisciplinary Courses		Humanities Social Science & Management				Experiential Learning Courses				CC (Co-Curricular Courses)
				MDM (Multidisciplinary minor	OE(Open Elective)	AEC(Ability Enhancement Course)	IKS(Indian Knowledge System)	VEC(Value education Course	Management Course	Research Methodology	Field Project	Project	Internship /OJT	
Credits	-	10/06	-	4	-	-	-	-	-	-	-	4	-	-
Cumulative Sum	16 / 13	49/18	7	14	08	04	02	04	04	-	2	5	-	04

PROGRESSIVE TOTAL CREDITS:125+24=149

Head of Dept. (Information Technology) Tulsiramji Gaikwad-Patil College of Engineering & Technology, Nagpur	Director Academics Tulsiramji Gaikwad-Patil College Of Engineering And Technology, Nagpur	Patil	Dr. Premanand Naktode Principal TGPCET, Nagpur	April, 2026	1.00	Applicable for AY 2023-24 Onwards
Chairperson	Vice-Principal/ Director Academics	Director Administration	Principal	Date of Release	Version	

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SCHEME OF INSTRUCTION & SYLLABI

Programme: B. Tech. in Information Technology

Scheme of Instructions: B. Tech. Information Technology (As Per NEP 2020)

Semester- VIII

Sr	Sem	Type	BoS/ Dept	Sub Code	Subject	T/P	Contact Hours			Credits	% Weightage			ESE Duration	Total Marks
							L	P	Hrs		CT/IA	CA	ESE		
1	VIII	OJT	IT	BIT34801	Industry Internship	P	-	26	26	13	-	100	100	3 Hrs	**200**
2		RM	ME	BME34802	Research Methodology	T	4	-	4	4	30	10	60	3 Hrs	**100**
Total							**4**	**26**	**30**	**17**	**30**	**110**	**160**	**6 Hrs**	**300**

Course Category	BSC/ ESC (Basic Science Course/ Engineering Science Course.)	PCC/PEC (Programme Core courses	VSEC (Skill Course)	Multidisciplinary Courses		Humanities Social Science & Management				Experiential Learning Courses				CC (Co-Curricular Courses)
				MDM (Multidisciplinary minor	OE(Open Elective)	AEC(Ability Enhancement Course)	IKS(Indian Knowledge System)	VEC(Value education Course	Management Course	Research Methodology	Field Project	Project	Internship /OJT	
Credits	-	-	-	-	-	-	-	-	-	04	-	04	13	-
Cumulative Sum	16 / 13	49/18	7	14	08	04	02	04	04	04	2	04	13	04

PROGRESSIVE TOTAL CREDITS:149+17=166

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SCHEME OF INSTRUCTION & SYLLABI

Programme: B. Tech. in Information Technology

Scheme of Instructions: B. Tech. Information Technology (As Per NEP 2020)

Programme: B. Tech In Information Technology

List of **Program Electives** offered by Information Technology Department

Program Elective- I	Program Elective-II	Program Elective- III	Program Elective- IV	Program Elective- V
Semester V	**Semester VI**	**Semester VI**	**Semester VII**	**Semester VII**
BIT33504- Software Engineering & Project Management	**BIT33603-** Ethical Hacking	**BIT33606-** Digital Forensics	**BIT34704-** Reinforcement Learning	**BIT34707-** Generative AI
BIT33505- Data Warehousing and Mining	**BIT33604-** Social Media Analytics	**BIT33607-** Big Data Analytics	**BIT34705-** Deep Learning	**BIT34708-** Information Retrieval
BIT33506- Cloud Computing	**BIT33605-** Cyber Laws and Ethics	**BIT33608-** Natural Language Processing	**BIT34706-** Computer Vision	**BIT34709-** Multimedia Forensics

Program: B. Tech in Information Technology

List of **Open Electives** offered by Information Technology

Open Elective-I	Open Elective-II	Open Elective-III
Semester-III	Semester-IV	Semester-V
BIT32312- Operating Systems	BIT32413- Artificial Intelligence	BIT33514- Cyber Security

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SCHEME OF INSTRUCTION & SYLLABI

Programme: B. Tech. in Information Technology

Scheme of Instructions: B. Tech. Information Technology (As Per NEP 2020)

Exit Course

Award of UG Certificate (After First Year)

Sr. No	Course Name	Mode of conduction	Credits
01	Networking/IT support	Certification Online/Offline/NPTEL	04
02	Programming in C++	Certification Online/Offline/NPTEL	04
OR			
03	Internship(16 week)	-	08
Total			**08**

Award of Diploma (After 2 Year)

Sr. No	Course Name	Mode of conduction	Credits
01	Artificial Intelligence	Certification Online/Offline/NPTEL	04
02	Cloud Computing	Certification Online/Offline/NPTEL	04
OR			
03	Internship(16 week)	-	08
Total			**08**

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SCHEME OF INSTRUCTION & SYLLABI

Programme: B. Tech. in Information Technology

Scheme of Instructions: B. Tech. Information Technology (As Per NEP 2020)

Exit Course

Award of Vocational Degree (After 3 Year)

Sr. No	Course Name	Mode of conduction	Credits
01	Cyber Security	Certification Online/Offline/NPTEL	04
02	Industry 4.0	Certification Online/Offline/NPTEL	04
OR			
03	Internship(16 week)	-	08
Total			**08**

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Tulsiramji Gaikwad-Patil College of Engineering and Technology

Wardha Road, Nagpur-441 108

NAAC Accredited (A+ Grade)

Fourth Year (Semester-VII) B. Tech. Information Technology

BIT34701: - Cryptography and Information Security

Teaching Scheme		Examination Scheme	
Theory	**3 Hrs/week**	CT-I	15 Marks
Tutorial	**-**	CT-II	15 Marks
Total Credits	**3**	CA	10 Marks
		ESE	60 Marks
		Total	100 Marks
		Duration of ESE: 3Hrs	

Course Objectives:

1.	To analyze security principles in cryptography.
2.	To illustrate asymmetric key cryptography including RSA and Diffie-Hellman.
3.	To study modern hashing algorithms and their security aspects.
4.	To classify key management techniques for secure communication.
5.	To study real-world cyber attack scenarios and their preventive measures.

Course Contents

Unit I	**System Security & Fundamentals**: Introduction to Information and Network Security, Types of Attacks, Modern Cyber Attacks: Phishing, Malware, Ransomware, DDoS, Security Concepts: CIA Triad, Threat, Vulnerability, Risk, Software Vulnerabilities: Buffer Overflow, Malicious Software: Viruses, Worms, Trojans, Intrusion Detection Systems (IDS), Firewalls, Introduction to Cryptography & Encryption Model
Unit II	**Cryptography Techniques:** Classical Ciphers, Modern Block Ciphers: DES, Triple DES, AES, Blowfish, Block Cipher Modes, Asymmetric Key Cryptography: RSA Algorithm, Diffie-Hellman Key Exchange, Euclidean algorithm, extended Euclidean algorithm, Elliptic Curve Cryptography (ECC), Applications of Cryptography
Unit III	**Authentication & Data Integrity**: Message Integrity & Authentication, Hash Functions & MAC, Algorithms: MD5, SHA-1, SHA-256, HMAC, Digital Signatures, Password Security: Hashing, Multi-Factor Authentication (MFA), Tokens
Unit IV	**Key Management & Access Control:** Symmetric Key Distribution & Key Agreement, Public Key Distribution, Digital Certificates & Public Key Infrastructure (PKI), Entity Authentication: Password-based, Challenge-Response Protocols, OTP-based authentication Biometrics, Zero Knowledge Proof, Recent trends in Information Security
Unit V	**Network & Application Security:** Security Protocols: Application Layer: PGP, Kerberos, Transport Layer: SSL/TLS, HTTPS, Network Layer: IPSec, Virtual Private Network (VPN) – concept, Web Security: SQL Injection, Cross-Site Scripting, Email Security, Cloud Security, Case Studies of Recent Cyber Attacks

Text Books	
T.1	William Stallings, Cryptography and Network Security: Principles and Practice, PHI 3rd Edition, 2006
T.2	Cryptography and networks security principles & practice by William Stalings (Pearson Education prentice Hall)
Reference Books	
R.1	Network Security and Cryptography: Bernard Menezes, 1st Edition, Cengage Learning
R.2	C K Shyamala, N Harini and Dr. T R Padmanabhan: Cryptography and Network Security, Wiley India Pvt. Ltd
Useful Links	
1	https://nptel.ac.in/courses/106105162

	Course Outcomes	CL	Class Sessions
BIT34701.1	Illustrate fundamental security principles in cryptography.	2	9
BIT34701.2	Classify cryptographic techniques used in securing communication systems.	2	9
BIT34701.3	Outline authentication mechanisms and their role in secure communication.	2	9
BIT34701.4	Discuss key management techniques and access control mechanisms in cryptographic systems.	2	9
BIT34701.5	Analyze network and application security protocols to identify appropriate security measures.	4	9

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NAAC Accredited with A+ Grade

(An Autonomous Institute Affiliated to RTM Nagpur University, Nagpur)

Fourth Year (Semester-VII) B.Tech. Information Technology

BIT34702: Cryptography & Information Security Lab

Teaching Scheme		Examination Scheme	
Practical	2 Hrs/week	CA	25 Marks
Total Credits	1	ESE	25 Marks
		Total	50 Marks

Sr. No	List of Practical	CO
1	To study and demonstrate different types of cyber attacks.	CO1
2	To study and configure basic firewall settings.	CO1
3	To perform encryption and decryption using RSA algorithm.	CO2
4	To implement Diffie–Hellman key exchange algorithm.	CO2
5	To generate hash values using different hashing algorithms.	CO3
6	To implement digital signature for message authentication.	CO3
7	To generate public and private keys and understand basic Public Key Infrastructure (PKI).	CO4
8	To implement password-based authentication using hashing.	CO4
9	To analyze secure communication using HTTPS and SSL/TLS.	CO5
10	To study basic web vulnerabilities and their impact.	CO5

Text Books	
T.1	William Stallings, Cryptography and Network Security: Principles and Practice, PHI 3rd Edition, 2006
T.2	Cryptography and networks security principles & practice by William Stalings (Pearson Education prentice Hall)
Reference Books	
R.1	Network Security and Cryptography: Bernard Menezes, 1st Edition, Cengage Learning
R.2	C K Shyamala, N Harini and Dr. T R Padmanabhan: Cryptography and Network Security, Wiley India Pvt. Ltd
Useful Links	
1	https://nptel.ac.in/courses/106105162
2	https://onlinecourses.nptel.ac.in/noc22_cs03/preview

	Course Outcomes	CL	Lab Sessions
BIT34702.1	Illustrate fundamental security principles in cryptography.	2	4
BIT34702.2	Classify cryptographic techniques used in securing communication systems.	2	4
BIT34702.3	Outline authentication mechanisms and their role in secure communication.	2	4
BIT34702.4	Discuss key management techniques and access control mechanisms in cryptographic systems.	2	4
BIT34702.5	Analyze network and application security protocols to identify appropriate security measures.	4	4

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NAAC Accredited (A+ Grade)

Fourth Year (Semester-VII) B. Tech. Information Technology

BIT34703: - Software Testing & Quality Assurance

Teaching Scheme	
Theory	**4 Hrs/week**
Tutorial	**-**
Total Credits	**4**

Examination Scheme	
CT-I	15 Marks
CT-II	15 Marks
CA	10 Marks
ESE	60 Marks
Total	100 Marks
Duration of ESE: 3Hrs	

Course Objectives:

1.	To understand the **fundamentals, principles, and lifecycle of software testing (STLC)** and its role in software development.
2.	To learn various **testing methodologies** including black-box and white-box techniques along with test design strategies.
3.	To gain practical knowledge of **manual and automated testing tools** such as Selenium, JUnit, TestNG, Postman, and JMeter.
4.	To develop an understanding of **software quality assurance practices**, quality metrics, and CI/CD integration.
5.	To study **quality management standards and modern trends** including Agile QA, DevOps, ISO, CMMI, and AI-based testing.

Course Contents

Unit I	**Testing Fundamentals & STLC:** Overview, Need & Principles of Software Testing, STLC Models, Agile Testing & DevOps Testing Pipeline, Unit Integration, System, Acceptance Testing, Smoke, Functional, Usability, Security, Regression Testing, Bug Lifecycle & Defect Tracking (JIRA)
Unit II	**Testing Methodologies:** Black Box & White Box Testing, Test Design Techniques, Test Planning & Test Cases, API Testing concepts, Mobile Application Testing, Validation & System Testing strategies
Unit III	**Testing Tools:** Test tool classification, Manual vs Automated Testing, Selenium WebDriver, TestNG, Junit, Postman for API Testing, JMeter for Performance Testing, Sonar Qube for Code Quality, Tools for Static & Dynamic Testing
Unit IV	**Quality Assurance:** Software Quality & QA vs QC, Quality Factors, Components, Plans & Metrics, CI/CD Pipeline & Quality Gates, Code Review practices, Costs of Software Quality
Unit V	**Quality Management:** SQA Requirements & Defect Prevention, Software Inspection & Process Improvement, Agile QA — Scrum, Kanban, ISO 9001 & CMMI Standards, AI-based Testing trends, Management's role in SQA, Management and its role in SQA - Quality management in IT

Text Books	
T.1	Software Testing — Ron Patton (Sams Publishing)
T.2	Software Testing and Quality Assurance — Kshirasagar Naik & Priyadarshi Tripathy (Wiley)
Reference Books	
R.1	*Software Quality Assurance* — **Daniel Galin** (Pearson)
R.2	*Software Engineering* — **Roger S. Pressman** (McGraw Hill) — QA chapters
Useful Links	
1	https://onlinecourses.nptel.ac.in/noc20_cs19/preview

	Course Outcomes	CL	Class Sessions
BIT34703.1	Explain software testing concepts in the context of industrial applications.	2	9
BIT34703.2	Illustrate testing methodologies, testing strategies in real-world applications.	2	9
BIT34703.3	Outline appropriate industrial testing tools for different testing scenarios	2	9
BIT34703.4	Apply software quality assurance practices, including quality metrics, code reviews, and CI/CD quality gates.	3	9
BIT34703.5	Evaluate software quality management practices, and emerging AI-based testing trend	5	9

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NAAC Accredited (A+ Grade)

Fourth Year (Semester-VII) B. Tech. Information Technology

BIT34704:- Reinforcement Learning

Teaching Scheme		Examination Scheme	
Theory	3 Hrs/week	CT-I	15 Marks
Tutorial	-	CT-II	15 Marks
Total Credits	3	CA	10 Marks
		ESE	60 Marks
		Total	100 Marks
		Duration of ESE: 3Hrs	

Course Objectives:

1.	To understand the fundamentals of Reinforcement Learning and its components.
2.	To model decision-making problems using Markov Decision Processes.
3.	To apply model-free and model-based RL algorithms.
4.	To analyze advanced RL techniques including Deep RL.
5.	To develop intelligent agents for real-world applications.

Course Contents

Unit I	**Introduction to Reinforcement Learning:** Basics of Machine Learning vs Reinforcement Learning, Elements of RL: Agent, Environment, Reward, Policy, Applications of RL (games, robotics, autonomous systems), Multi-Armed Bandit Problem, Action-value methods, Exploration vs Exploitation
Unit II	**Markov Decision Processes (MDP):** Markov Property, MDP Framework: States, Actions, Rewards, Policies and Value Functions, Bellman Equations (Expectation & Optimality), Dynamic Programming: Policy Iteration & Value Iteration
Unit III	**Model-Free Reinforcement Learning:** Monte Carlo Methods, Temporal Difference Learning (TD), SARSA Algorithm, Q-Learning, Double Q-Learning, n-step TD, Expected SARSA
Unit IV	**Advanced Reinforcement Learning:** Eligibility Traces, Function Approximation, Deep Q-Networks (DQN), Policy Gradient Methods, Actor-Critic Methods
Unit V	**Advanced Topics & Applications:** Partially Observable MDPs (POMDPs), Hierarchical Reinforcement Learning, Multi-Agent Reinforcement Learning, Real-world Applications, Ethics & Safety in RL, RL in NLP / ChatGPT (RLHF) Case Studies

Text Books

T.1	Reinforcement Learning: An Introduction **by Richard S. Sutton & Andrew G. Barto,** Publication: MIT Press, Edition: 2nd Edition, 2018
T.2	Foundations of Deep Reinforcement Learning **by Laura Graesser & Wah Loon Keng,** Publication: Addison-Wesley, Edition: 2020

Reference Books	
R.1	Hands-On Reinforcement Learning with Python by **Sudharsan Ravichandiran** Publication: Packt, Edition: 2018
R.2	Reinforcement Learning with TensorFlow **by Sayon Dutta** Publication: Packt, Edition: 2018
Useful Links	
1	https://onlinecourses.nptel.ac.in/noc19_cs55/preview

	Course Outcomes	CL	Class Sessions
BIT34704.1	Explain key concepts of Reinforcement Learning and its architecture	2	9
BIT34704.2	Illustrate Markov Decision Processes (MDPs) and Bellman equations in reinforcement learning	2	9
BIT34704.3	Apply model-free reinforcement learning algorithms to solve problems.	3	9
BIT34704.4	Demonstrate advanced reinforcement learning methods, including deep Q-networks and policy gradient techniques.	3	9
BIT34704.5	Evaluate real-world reinforcement learning applications and ethical considerations of RL.	5	9

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NAAC Accredited (A+ Grade)

Third Year (Semester-VII) B. Tech. Information Technology

BIT34705: - Deep Learning

Teaching Scheme	
Theory	**3 Hrs/week**
Tutorial	**-**
Total Credits	**3**

Examination Scheme	
CT-I	15 Marks
CT-II	15 Marks
CA	10 Marks
ESE	60 Marks
Total	100 Marks
Duration of ESE: 3Hrs	

Course Objectives:

1.	To understand the fundamentals of deep learning and neural networks.
2.	To study architectures in deep learning such as CNN and RNN.
3.	To apply deep learning techniques for solving real-world problems.
4.	To analyze performance and challenges of deep learning models.
5.	To design and implement intelligent systems using deep learning.

Course Contents

Unit I	Introduction to Deep Learning: Introduction to Artificial Intelligence, Machine Learning, and Deep Learning, Biological Neuron vs Artificial Neuron, Perceptron Model, Activation Functions (Sigmoid, ReLU, Tanh, Softmax), Loss Functions and Optimization Basics, Introduction to Python libraries: NumPy, TensorFlow, Keras, PyTorch
Unit II	Neural Networks Fundamentals: Feedforward Neural Networks, Multilayer Perceptron (MLP), Forward Propagation and Backpropagation Algorithm, Gradient Descent and its variants (SGD, Adam), Overfitting and Regularization Techniques (Dropout, L1/L2)
Unit III	Convolutional Neural Networks (CNN): Introduction to CNN, Convolution Operation and Pooling, CNN Architectures (LeNet, AlexNet, VGG), Image Classification and Feature Extraction, Transfer Learning, ResNet & Inception
Unit IV	Recurrent Neural Networks (RNN): Sequence Modeling, Recurrent Neural Networks RNN), Bidirectional RNN, Vanishing Gradient Problem, LSTM (Long Short-Term Memory) and GRU, Applications in NLP and Time Series
Unit V	Advanced Deep Learning & Applications: Autoencoders, Generative Adversarial Networks (GANs), Deep Reinforcement Learning, Transformer Architecture & BERT. Natural Language Processing with Deep Learning, Deep RL Case Studies and Real-world Applications

Text Books

T.1	*Deep Learning with PythonFrançois CholletManning Publications2nd Edition, 2021*
T.2	*Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlowAurélien GéronO'Reilly Media3rd Edition, 2022*

Reference Books	
R.1	Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow **by Aurélien Géron** Publication: O'Reilly Media, Edition: 3rd Edition, 2022
R.2	Natural Language Processing with TransformersLewis Tunstall, Leandro von Werra & Thomas WolfO'Reilly Media 2022
Useful Links	
1	Deep Learning Specialization — Andrew Ng (Coursera)https://www.coursera.org/specializations/deep-learning
2	https://onlinecourses.nptel.ac.in/noc26_cs66/preview

	Course Outcomes	CL	Class Sessions
BIT34705.1	Explain the fundamental concepts of deep learning and neural networks	2	9
BIT34705.2	Illustrate optimization techniques and backpropagation in neural networks	2	9
BIT34705.3	Classify CNN and RNN models for various real-world applications	2	9
BIT34705.4	Outline deep learning architectures and evaluate their performance	2	9
BIT34705.5	Demonstrate deep learning-based solutions for real-world problems	3	9

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NAAC Accredited (A+ Grade)

Final Year (Semester-VII) B. Tech. in Information Technology

BIT34706: Computer Vision

Teaching Scheme	
Theory	**3 Hrs/week**
Tutorial	**-**
Total Credits	**3**

Examination Scheme	
CT-I	15 Marks
CT-II	15 Marks
CA	10 Marks
ESE	60 Marks
Total	100 Marks
Duration of ESE: 3Hrs	

Course Objectives:

1.	To introduce the fundamentals of computer vision and image formation processes.
2.	To develop knowledge of image processing techniques for digital image analysis.
3.	To provide understanding of feature detection and image analysis methods.
4.	To present concepts of image understanding and recognition techniques.
5.	To familiarize students with applications and recent trends in computer vision.

Course Contents

Unit I	**Introduction to Computer Vision:** Definition, working, comparison with human vision, tasks and applications. Difference between image processing and computer vision. **Image Formation:** Image formation, light and reflection, digital camera, sensors and image sensing pipeline. **Cameras:** Pinhole camera model and its working
Unit II	**Image Processing Fundamentals:** Digital images, image representation (grayscale and color), intensity values and image operations. **Image Enhancement:** Brightness and contrast, enhancement techniques, noise and noise removal methods. **Image Filtering:** Filtering, smoothing, sharpening and edge detection. **Image Segmentation:** Segmentation, thresholding and region-based segmentation. Histogram Equalization
Unit III	**Feature Detection & Image Analysis** **Feature Detection:** Image features, edges, corners and feature extraction. **Edge and Corner Detection:** Edge detection, corner detection and their role in image analysis. **Image Matching:** Matching features between images and applications. **Motion Analysis:** Motion in images, motion detection and tracking, Optical Flow, SIFT, SURF, ORB

Unit IV	**Image Understanding & Recognition** **Image Understanding:** Pattern recognition, object recognition and image classification. **Image Recognition:** Face detection and recognition, 3D vision, depth and shape from images. Deep Learning for Recognition, Semantic Segmentation
Unit V	**Applications & Modern Trends in Computer Vision** **Computer Vision Applications:** Medical imaging, biometric systems, face recognition, smart cameras and security systems. **AI in Computer Vision:** Artificial intelligence in computer vision and neural networks overview, Generative Models in Vision **Recent Trends:** Autonomous vehicles, augmented reality and smart surveillance systems.
Text Books	
T.1	Computer Vision: Algorithms and Applications Richard SzeliskiSpringer2nd Edition, 2022
Reference Books	
R.1	Rafael C. Gonzalez, R. E. Woods and Eddins S. L., *Digital Image Processing*, Pearson, 4th Edition, 2019.
R.2	Learning OpenCV 4Adrian Kaehler & Gary BradskiO'Reilly Media2019
Useful Links	
1	https://nptel.ac.in/courses/106106224
2	Hugging Face — Vision Transformers & Modelshttps://huggingface.co/models?pipeline_tag=image-classification

	Course Outcomes	CL	Class Sessions
BIT34706.1	Describe computer vision fundamentals, image formation and camera models.	2	9
BIT34706.2	Illustrate image processing techniques for enhancement, filtering and segmentation to analyze digital images.	2	9
BIT34706.3	Outline image features involving edges and corners, and interpret feature matching and motion analysis.	2	9
BIT34706.4	Discuss methods of image understanding and recognition for object classification and face detection	2	9
BIT34706.5	Explain real-world applications of computer vision and the role of artificial intelligence in modern vision systems.	2	9

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Wardha Road, Nagpur-441 108

NAAC Accredited (A+ Grade)

Final Year (Semester-VII) B. Tech. Information Technology

BIT34707: Generative AI

Teaching Scheme	
Theory	**3 Hrs/week**
Tutorial	**-**
Total Credits	**3**

Examination Scheme	
CT-I	15 Marks
CT-II	15 Marks
CA	10 Marks
ESE	60 Marks
Total	100 Marks
Duration of ESE: 3Hrs	

Course Objectives:

1.	To understand the fundamentals of Generative AI and its evolution from traditional AI and Machine Learning
2.	To explore text and image generation techniques using modern Generative AI tools and models
3.	To study video, audio and multimodal AI generation tools and their real-world applications
4.	To analyze core Generative AI architectures including Transformers, GANs, VAEs, Diffusion Models and LLMs
5.	To evaluate ethical considerations, regulatory frameworks and future trends in Generative AI

Course Contents

Unit I	**Basics of Generative AI** Introduction to Generative AI, AI vs ML vs Generative AI, History of Generative AI, Basics of Neural Networks, Introduction to Deep Learning, Natural Language Processing, Types of Generative AI (Text, Image, Video), Advantages and Limitations of Generative AI.
Unit II	**Generative Texts and Images: Generative Texts:** Basics of AI chatbots, Working of Chatbots, Text Generation Applications, Popular tools like ChatGPT, and practical use cases. **Generative Images:** AI in image creation, tools like MidJourney, their working, pros/cons, and applications. **Diffusion Models** — Stable Diffusion, DALL-E , **Prompt Engineering**
Unit III	**Generative Videos** AI video creation tools, Synthesia—its features, usage, benefits, limitations, and practical case studies, Runway ML, Pika Labs, Sora (OpenAI), AI Audio & Music Generation Multimodal AI — GPT-4V, Gemini
Unit IV	**Generative Models:** Introduction to Encoder-Decoder Architecture and Introduction to Generative AI Models, Transformer Architecture & Diffusion Models, Large Language Models (LLMs), Generative Adversarial Networks (GANs) and Variational Autoencoders (VAEs).

Unit V	**Applications and Ethical Considerations** Applications of Generative AI in Text Generation, AI Chatbots, Image and Video Creation, Music Composition, Healthcare, Finance, Education, and Marketing. **Ethical Issues:** Bias, Deepfakes, Privacy, Intellectual Property, Responsible AI, Transparency, Explainability, and AI Regulations. Challenges and Limitations in real-world deployment, Social Impact, and Case Studies of AI in Industry. Ethics, Regulations & Future Trends
Text Books	
T.1	David Foster, Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play, O'Reilly Media, 2019.
T.2	Numa Dhamani, Introduction to Generative AI, Kindle Edition, 2004
Reference Books	
R.1	Mark Coeckelbergh, AI Ethics, MIT Press, 2020.
R.2	Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach,
Useful Links	
1	https://www.coursera.org/learn/generative-ai-for-everyone
2	https://www.coursera.org/learn/generative-ai-ethical-considerations-and-implications

	Course Outcomes	CL	Class Sessions
BIT34707.1	Explain fundamentals of Generative AI, Neural Networks and NLP basics	2	9
BIT34707.2	Discuss AI image and text generation tools for practical content creation and communication tasks.	2	9
BIT34707.3	Illustrate AI video generation using tools including practical use cases.	2	9
BIT34707.4	Describe generative models to create AI-generated content.	2	9
BIT34707.5	Classify ethical issues, AI regulations and real-world applications of Generative AI across industries	2	9

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NAAC Accredited (A+ Grade)

Final Year (Semester-VII) B. Tech. Information Technology

BIT34708: Information Retrieval

Teaching Scheme		Examination Scheme	
Theory	3 Hrs/week	CT-I	15 Marks
Tutorial	-	CT-II	15 Marks
Total Credits	3	CA	10 Marks
		ESE	60 Marks
		Total	100 Marks
		Duration of ESE: 3Hrs	

Course Objectives:

1.	To understand the fundamentals of Information Retrieval, text processing and indexing techniques
2.	To study ranking models including TF-IDF, Vector Space Model, BM25 and query expansion techniques
3.	To apply practical IR tools including PyLucene and FAISS for document indexing and querying.
4.	To evaluate IR systems using standard metrics including Precision, Recall, MAP, NDCG and A/B Testing
5.	To explore modern IR techniques including Web Search, PageRank, Semantic Search, BERT and RAG

Course Contents

Unit I	**Basics of Information Retrieval & Indexing:** Introduction to IR and digital documents, Text processing: tokenization, term filtering, Term-document matrix, Boolean retrieval and inverted index Simple query processing, Stemming & Lemmatization, Stop word removal, N-grams
Unit II	**Ranking and Retrieval Models:** TF, TF-IDF, cosine similarity, Vector Space Model (VSM), Introduction to probabilistic models: BM25 basics, Simple ranking of documents, Language Models for IR, Query Expansion
Unit III	**Practical Querying & Tools**: Introduction to PyLucene, FAISS, Creating and indexing documents, Simple queries: Term Query, Boolean Query, Phrase Query, Practicing searches on small datasets
Unit IV	**Evaluation of Retrieval:** Precision, recall, F-measure, Precision@K , Average precision and MAP, Simple relevance feedback, NDCG (Normalized Discounted Cumulative Gain), A/B Testing for Search, Evaluating search results on sample datasets
Unit V	**Web Search and Modern IR Techniques:** Introduction to web search and crawling, PageRank and HITS, Latent Semantic Indexing (LSI), Word, sentence and document embeddings, Semantic Search, Simple applications of BERT and LLMs in IR, Dense Retrieval & DPR, RAG (Retrieval Augmented Generation)

Text Books	
T.1	Search Engines: Information Retrieval in Practice Bruce Croft, Donald Metzler & Trevor StrohmanPearson2nd Edition, 2015
T.2	Information Retrieval: Implementing and Evaluating Search Engines Stefan Buttcher, Charles Clarke & Gordon Cormack MIT Press2010
Reference Books	
R.1	Practical Natural Language Processing Sowmya Vajjala, Bodhisattwa Majumdar & Anuj Gupta O' Reilly Media 2020
R.2	Natural Language Processing with Transformers Lewis Tunstall, Leandro von Werra & Thomas WolfO'Reilly Media 2022
Useful Links	
1	https://onlinecourses.nptel.ac.in/noc26_cs13/preview

	Course Outcomes	CL	Class Sessions
BIT34708.1	Explain IR fundamentals, text processing, tokenization, stemming and inverted index construction.	2	9
BIT34708.2	Discuss TF-IDF, VSM, BM25 and query expansion techniques for document ranking and retrieval	2	9
BIT34708.3	Illustrate document indexing and querying using PyLucene and FAISS on real datasets	2	9
BIT34708.4	Classify IR systems using Precision, Recall, MAP, NDCG and A/B Testing methodologies	2	9
BIT34708.5	Analyze modern IR techniques including PageRank, Semantic Search, BERT, DPR and RAG	4	9

Head of Dept. (Information Technology)
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Final Year (Semester-VII) B. Tech. Information Technology

BIT34709: Multimedia Forensics

Teaching Scheme			Examination Scheme	
Theory	**3 Hrs/week**		CT-I	15 Marks
Tutorial	**-**		CT-II	15 Marks
Total Credits	**3**		CA	10 Marks
			ESE	60 Marks
			Total	100 Marks
			Duration of ESE: 3Hrs	

Course Objectives:

1.	**Understand** the foundational principles of digital and multimedia forensics, including types of cybercrime, digital evidence, and the forensic investigation process.
2.	**Describe** the characteristics and processing of multimedia data (images, audio, and video), and explain basic methods for identifying forgery and manipulation.
3.	**Demonstrate practical knowledge** of multimedia forensic techniques such as spectrogram analysis, speaker identification, and frame-level video examination.
4.	**Evaluate** the use of forensic tools and methodologies for data acquisition, evidence duplication, and investigation workflows in real-world scenarios.
5.	**Implement ethical and legal practices** in handling and presenting multimedia evidence in compliance with relevant Indian laws such as the Indian IT Act.

Course Contents

Unit I	**Introduction to Digital & Multimedia Forensics:** Basics of digital forensics, Types of cybercrime and digital evidence, Multimedia evidence: image, audio, video, Forensic investigation process, Chain of custody, File Systems & Storage Basics, Hash Functions in Forensics, Steganography
Unit II	**Image Forensics:** Basics of digital images and formats, Metadata (EXIF basics), Image compression, Types of image forgery: Copy-move, Image editing, Simple forgery detection methods, Tools: Foto Forensics, Ghiro
Unit III	**Audio Forensics:** Basics of digital audio and formats**,** Sound waves and noise**,** Audio tampering (cut, edit, mix) **,** Spectrogram basics, Introduction to speaker identification, Voice Biometrics, Audacity, Adobe Audition
Unit IV	**Video Forensics:** Basics of video (frames, frame rate), Video compression basics, Video editing and tampering, Frame-level analysis, Introduction to deepfake detection **DeepFake Detection tools** — Face Forensics++, Deep Ware, GAN-based forgery detection

Unit V	**Tools, Applications & Legal Aspects:** Introduction to forensic tools and techniques, Data acquisition and duplication, Applications in cybercrime investigation, Indian IT Act and digital evidence laws Ethics in multimedia forensics, Information Technology Amendment Act 2008**,** Expert Witness testimony
Text Books	
T.1	Multimedia Forensics : Husrev Taha Sencar , Luisa Verdoliva , Nasir Memon
T.2	Multimedia Forensics and Security: Foundations, Innovations, and Applications:Ella Hassanien , Mohamed Mostafa Fouad , Azizah Abdul Manaf
Reference Books	
R.1	Practical Forensic Imaging: Securing Digital Evidence with Linux Tools by Bruce Nikkel Publisher: Syngress
R.2	Video Forensics: An Optimized Approach by Md. Abul Hasnat, Zahid Akhtar Publisher: CRC Press
Useful Links	
1	https://onlinecourses.nptel.ac.in/noc26_lw01/preview

	Course Outcomes	CL	Class Sessions
BIT34709.1	Explain fundamentals of digital forensics, cybercrime types, chain of custody and forensic investigation process	2	9
BIT34709.2	Illustrate image forgery techniques including copy-move, metadata analysis and simple forgery detection methods	2	9
BIT34709.3	Outline audio forensics techniques including spectrogram analysis, tampering detection and speaker identification	2	9
BIT34709.4	Analyze the authenticity and reliability of multimedia evidence in forensic investigations.	4	9
BIT34709.5	Demonstrate use of forensic tools for cybercrime investigation under Indian IT Act and digital evidence laws	3	9

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Fourth Year (Semester-VII) B. Tech. Information Technology

BEC34710:-Embedded System and Interfacing

Teaching Scheme	
Theory	**4 Hrs/week**
Tutorial	**-**
Total Credits	**4**

Examination Scheme	
CT-I	15 Marks
CT-II	15 Marks
CA	10 Marks
ESE	60 Marks
Total	100 Marks
Duration of ESE: 3Hrs	

Course Objectives:

1.	**To** Understand the concept, definition, and classification of embedded systems.
2.	**To** Analyze interrupts and timer operations.
3.	**To** Interface sensors and communication modules.
4.	**To** Explain communication protocols in embedded systems.
5.	**To** Apply synchronization mechanisms.

Course Contents

Unit I	History, Definition, and Classification of Embedded System, Design Metric & Its optimization, Embedded System Design Challenges, Processor selection Criteria, Building blocks of typical Embedded System –Memory Architecture, Memory & Its Types, RISC and CISC.
Unit II	Introduction to ARM, features, architecture, instruction set features, Concepts of RTOS ARM processor and Architecture, Register set, instruction set, programming, interrupts, stack, timers on-chip and off chip peripherals, interfacing and programming.
Unit III	Analyzing Inbuilt of ADC and DAC of ARM7TDMI Microcontroller, Applications based on PWM, Interfacing of Temperature Sensor, USART, Bluetooth, USB Drive, LCD display, GSM and GPS Module.
Unit IV	Protocol of Embedded System:- Bluetooth ,USB Drive,I2C Bus, CAN Bus, IEEE 802.11,,RS232,RS485 ,GPRS, IEEE 802.15, Modbus, Zigbee Architecture.
Unit V	Architecture of the kernel, Task scheduler, Semaphores, Mailbox,Message queues , Pipes, Events, Timers , Memory Management, Case study- Based on Communication Embedded System, Based on Automation Embedded Systems.

Text Books

T.1	Joseph Yiu, The Definitive Guide to ARM Cortex-M3 and Cortex-M4 Processors, Newnes Publications; 3rd edition, 2013.

T.2	Frank Vahid and Tony Givargis, ―Embedded System Design‖, John Wiley & sons Inc.3rd Edition.
Reference Books	
R.1	William hohl and Christoper Hinds, ―ARM assembly language fundamentals and Techniques CRC, 2nd edition,2015
R.2	Atmel AVR Microcontroller Primer: Programming and Interfacing by Steven F. Barrett, Daniel J. Pack, Morgan & Claypool Publishers ,2012
Useful Links	
1	https://onlinecourses.nptel.ac.in/noc25_cs41/preview?
2	https://elearn.nptel.ac.in/shop/nptel/embedded-system-design-with-arm/?

	Course Outcomes	CL	Class Sessions
BEC34710.1	**Explain** embedded system concepts and classifications.	2	(9)
BEC34710.2	**Interface** ARM with external devices.	3	(9)
BEC34710.3	**Implement** PWM-based applications.	3	(9)
BEC34710.4	**Apply** protocols in embedded applications.	3	(9)
BEC34710.5	**Analyze** memory and timing mechanisms.	4	(9)

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Final Year (Semester-VII) B. Tech. Information Technology

BCE4804: Sustainable Development Goals

Teaching Scheme		Examination Scheme	
Lectures	2 Hrs./week	**CIE**	20 Marks
Tutorial	-	**ESE**	30 Marks
Total Credit	2	**Total**	50 Marks
		Duration of ESE: 01 Hrs. 00 Min.	

Course Objectives:

1.	To develop a comprehensive understanding of the UN Sustainable Development Goals (SDGs) and their interconnections.
2.	To analyze the global challenges addressed by the SDGs and their impact on various sectors.
3.	To explore innovative solutions and best practices for implementing the SDGs.
4.	To evaluate the progress made towards achieving the SDGs at national and international levels.
5.	To foster a sense of global citizenship and social responsibility among students.

Course Contents		Hours
Unit I	**Introduction to Sustainable Development Goals (SDGs):** Definition of Sustainability, Aspects of sustainability, historical perspective of sustainable development, Climate Change Conferences and Summits, the Brundtland Commission Report, transition from Millennium Development Goals (MDGs) to SDGs, the role of UN and the need for SDGs and Adoption by the World, scope and inclusion of the 2030 Agenda for Sustainable Development.	**(7)**
Unit II	**Framework & Structuring of the 17 SDGs:** SDG 1: No Poverty, SDG 2: Zero Hunger, SDG 3: Good Health and Well-being, SDG 4: Quality Education, SDG 5: Gender Equality, SDG 6: Clean Water and Sanitation, SDG 7: Affordable and Clean Energy, SDG 8: Decent Work and Economic Growth, SDG 9: Industry, Innovation and Infrastructure, SDG 10: Reduced Inequalities, SDG 11: Sustainable Cities and Communities, SDG 12: Responsible Consumption and Production, SDG 13: Climate Action, SDG 14: Life below Water, SDG 15: Life on Land, SDG 16: Peace, Justice and Strong Institutions, SDG 17: Partnerships for the Goal	**(7)**
Unit III	**SDGs Implementation and Future Perspectives:** Interconnections between the SDGs, the role of technology and innovation in SDG implementation, financing the SDGs, measuring SDG progress, future challenges and opportunities, Climate change and its impact on sustainable development, Case studies of successful SDG implementation – India, World	**(7)**

Text Books

1	Hazra, Somnath., Bhukta, Anindya (2020) Sustainable Development Goals An Indian Perspective, Springer International Publishing, Switzerland
2	Ziai, Aram (2016) Development Discourse and Global History from colonialism to the sustainable development goals. Routledge, London & New York

Reference Books	
1	Sachs, J., Schmidt-Traub, G., Kroll, C., Lafortune, G., Fuller, G., Woelm, F. 2020. The Sustainable Development Goals and COVID-19. Sustainable Development Report 2020. Cambridge: Cambridge University Press.
2	OECD (2019), Sustainable Results in Development: Using the SDGs for Shared Results and Impact, OECD Publishing, Paris, https://doi.org/10.1787/368cf8b4-en.

Useful Links
1. https://nptel.ac.in/courses/109106200
2. https://www.un.org/sustainabledevelopment/

BCE4804	Course Outcomes	CL
CO 1	To explore the historical origins and evolution of the UN-SDGs.	2
CO 2	To analyze the 17 SDGs and their interlinkages.	2
CO 3	To analyze the role of technology and innovation in achieving the SDGs along with future challenges and opportunities.	2

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