

Rajiv Gandhi Proudyogiki Vishwavidyalaya, Bhopal
New Scheme of Examination as per AICTE Flexible Curricula
VII Semester
Bachelor of Technology (B.Tech.) 3 D Animation & Graphics
Syllabus (w.e.f. July, 2023)
AG 701 Augmented and Virtual Reality

Course Objective: The objective of this course is to provide students a general introduction of Virtual and Augmented Environments followed by an analysis of features, requirement and issues in real-life applications.

Unit I Introduction to Virtual Reality- Virtual Reality and Virtual Environment: Introduction, Applications of Virtual Reality, Computer graphics, Real time computer graphics, Flight Simulation, Virtual environment requirement, benefits of virtual reality, Historical development of VR, Scientific Landmark 3D Computer Graphics: Introduction, The Virtual world space, positioning the virtual observer, the perspective projection, human vision, stereo perspective projection, 3D clipping, Colour theory, Simple 3D modeling, Illumination models, Reflection models, Shading algorithms, Radiosity, Hidden Surface Removal, Realism-Stereographic image.

Unit II Geometric Modeling- Geometric Modeling: Introduction, From 2D to 3D, 3D space curves, 3D boundary representation Geometrical Transformations: Introduction, Frames of reference, Modeling transformations, Instances, Picking, Flying, Scaling the VE, Collision detection Generic VR system: Introduction, Virtual environment, Computer environment, VR technology, Model of interaction, VR Systems.

Unit III Virtual Environment -Animating the Virtual Environment: Introduction, The dynamics of numbers, Linear and Nonlinear interpolation, the animation of objects, linear and non-linear translation, shape & object in between, free from deformation, particle system. Physical Simulation: Introduction, Objects falling in a gravitational field, Rotating wheels, Elastic collisions, projectiles, simple pendulum, springs, Flight dynamics of an aircraft.

Unit IV VR Hardware and Software- Human factors: Introduction, the eye, the ear, the somatic senses. VR Hardware: Introduction, sensor hardware, Head-coupled displays, Acoustic hardware, Integrated VR systems. VR Software: Introduction, Modeling virtual world, Physical simulation, VR toolkits, Introduction to VRML

Unit V Augmented and Mixed Reality- Taxonomy, Technology and features of augmented reality, difference between AR and VR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality, wireless displays in educational augmented reality applications, mobile projection interfaces, marker-less tracking for augmented reality, enhancing interactivity in AR environments, evaluating AR systems.

References:

1. John Vince, "Virtual Reality Systems ", Pearson Education Asia, 2007.
2. Anand R., "Augmented and Virtual Reality", Khanna Publishing House, Delhi.
3. Adams, "Visualizations of Virtual Reality", Tata McGraw Hill, 2000.
4. Grigore C. Burdea, Philippe Coiffet , "Virtual Reality Technology", Wiley Inter Science, 2 nd Edition,

2006.

5. William R. Sherman, Alan B. Craig, "Understanding Virtual Reality: Interface, Application and Design", Morgan Kaufmann, 2008.

6. Alan B Craig, William R Sherman and Jeffrey D Will, Developing Virtual Reality Applications: Foundations of Effective Design, Morgan Kaufmann, 2009.

7. Gerard Jounghyun Kim, Designing Virtual Systems: The Structured Approach, 2005.

8. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013.

Course Outcomes:

After the completion of this course, the students will be able to:

1. Demonstrate knowledge of virtual reality and its applications
2. To describe the importance of viewing and projections.
3. Understand geometric modeling and Virtual environment.
4. Explain about virtual reality hardware and software
5. Develop Virtual Reality applications.

AG702(A) Visual Effects

Course Objective: Enable the students to gain a comprehensive understanding on how Visual Effects are created.

UNIT I Introduction to Visual Effects (VFX): The aim of visual effects, Special effects vs Visual effects, The origins of visual effects, VFX pipeline, VFX Cues, Data Transfer, Color Depth, and Compression, Resolution and Aspect Ratio Comparisons, Digital formats, VFX Concepts, CGI

UNIT II Compositing: Applications, purpose of compositing, compositing techniques, Digital Compositing with CGI, Compositing Visual Effects, The CGI Composite, Multipass Compositing, Depth Compositing, Multiplane Compositing, Bluescreen Compositing, Creating Masks

UNIT III Rotoscoping: concept and applications, Introducing Roto, Splines, Articulated Rotos, Interpolation, key frames, Motion Blur, Semi transparency

UNIT IV Image Blending: various operations like Mix, Multiply, Screen, Maximum, Minimum, Add, Subtract, Blending modes, speed changes,
Animation: Transforms and pixels, filters, pivot points, transformation order, keyframe animation, motion blur, motion tracking, warps, morphs

UNIT V Digital Environment Applications, Film Colorization, Digital Beauty, Particle Systems, Dynamics, 2.5D vs. 3D Particle-Based Crowd Replications, Digital Destruction, Methods of 2D-to-3D Stereoscopic Conversions

The VFX Workflow: Preproduction, Camera Tracking, Layout, Modeling, Texturing and Shading, Rigging, Animation, Lighting and Rendering, Compositing, Matte painting, Dynamic Simulations, Particle Systems, Crowd Simulation

References:

1. Compositing Visual Effects, Steve Wright, Focal Press, Elsevier
2. Visual Effects and Compositing, Jon Gress, New Riders, Pearson Education
3. Filming the Fantastic A Guide to Visual Effects Cinematography, Mark Sawicki, Elsevier
4. The Film Makers Guide to Visual Effects, Eran Dinur, Taylor and Francis

Course Outcomes:

After the completion of this course, the students will be able to:

1. Understand visual effects basic concepts
2. Understand Compositing techniques and applications
3. Describe rotoscoping process
4. Understand image blending operations
5. Apply the knowledge of VFX Workflow in projects

AG702(B) Machine Learning

Course Objective: To familiarize students with the knowledge of machine learning and enable them to apply suitable machine learning techniques for data handling and to gain knowledge from it. Evaluate the performance of algorithms and to provide solution for various real-world applications.

Unit I Introduction: Introduction, Examples of various Learning Paradigms, Perspectives and Issues, Concept Learning, Version Spaces, Finite and Infinite Hypothesis Spaces, PAC Learning, VC Dimension

Unit II Supervised Learning Algorithms: Learning a Class from Examples, Linear, Non-linear, Multi-class and Multi-label classification, Decision Trees: ID3, Classification and Regression Trees (CART), Regression: Linear Regression, Multiple Linear Regression, Logistic Regression, Neural Networks: Introduction, Perceptron, Multilayer Perceptron, Support vector machines: Linear and NonLinear, Kernel Functions, K-Nearest Neighbors

Unit III Ensemble Learning: Ensemble Learning Model Combination Schemes, Voting, Error-Correcting Output Codes, Bagging: Random Forest Trees, Boosting: Adaboost, Stacking

Unit IV Unsupervised Learning: Introduction to clustering, Hierarchical: AGNES, DIANA, Partitional: K-means clustering, KMode Clustering, Self-Organizing Map, Expectation Maximization, Gaussian Mixture Models, Principal Component Analysis (PCA), Locally Linear Embedding (LLE), Factor Analysis

Unit V Probabilistic Learning: Bayesian Learning, Bayes Optimal Classifier, Naïve Bayes Classifier, Bayesian Belief Networks, Mining Frequent Patterns

References:

1. EthemAlpaydin, "Introduction to Machine Learning", MIT Press, Prentice Hall of India, Third Edition 2014.
2. MehryarMohri, AfshinRostamizadeh, AmeetTalwalkar "Foundations of Machine Learning", MIT Press, 2012.
3. Tom Mitchell, "Machine Learning", McGraw Hill, 3rd Edition, 1997.
4. Charu C. Aggarwal, "Data Classification Algorithms and Applications", CRC Press, 2014.
5. Stephen Marsland, "Machine Learning – An Algorithmic Perspective", 2nd Edition, CRC Press, 2015.
6. Kevin P. Murphy "Machine Learning: A Probabilistic Perspective", The MIT Press, 2012
7. Jiawei Han and MichelineKambers and Jian Pei, "Data Mining –Concepts and Techniques", 3rd Edition, Morgan Kaufman Publications, 2012.
8. Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, "Mathematics for Machine Learning", Cambridge University Press, 2019.

Course Outcomes:

After the completion of this course, the students will be able to:

1. Recognize the characteristics of machine learning strategies.
2. Apply various supervised learning methods to appropriate problems.
3. Identify and integrate more than one technique to enhance the performance of learning.
4. Create probabilistic and unsupervised learning models for handling unknown pattern.
5. Analyze the co-occurrence of data to find interesting frequent patterns and Preprocess the data before applying to any real-world problem and can evaluate its performance

AG702(C) Robotics

Course Objective: The objective of this course is to impart knowledge about industrial robots for their control and design.

Unit I Introduction to Robotics: Types and components of a robot, Classification of robots, closed-loop and open-loop control systems; Kinematics systems: Definition of mechanisms and manipulators, Social issues and safety

Unit II Robot Kinematics and Dynamics: Kinematic Modelling: Translation and Rotation Representation, Coordinate transformation, DH parameters, Jacobian, Singularity, and Statics; Dynamic Modelling: Equations of motion: Euler-Lagrange formulation

Unit III Sensors and Vision System: Sensor: Contact and Proximity, Position, Velocity, Force, Tactile etc. Introduction to Cameras, Camera calibration, Geometry of Image formation, Euclidean/Similarity/Affine/Projective transformations, Vision applications in robotics.

Unit IV Robot Control: Basics of control: Transfer functions, Control laws: P, PD, PID, Non-linear and advanced controls Robot Actuation Systems: Actuators: Electric, Hydraulic and Pneumatic; Transmission: Gears, Timing Belts and Bearings, Parameters for selection of actuators.

Unit V Control Hardware and Interfacing: Embedded systems: Architecture and integration with sensors, actuators, components, Programming for Robot Applications

References:

1. Saha, S.K., "Introduction to Robotics, 2nd Edition, McGraw-Hill Higher Education, New Delhi, 2014.
2. Ghosal, A., "Robotics", Oxford, New Delhi, 2006.
3. Niku Saeed B., "Introduction to Robotics: Analysis, Systems, Applications", PHI, New Delhi.
4. Mittal R.K. and Nagrath I.J., "Robotics and Control", Tata McGraw Hill.
5. Mukherjee S., "Robotics and Automation", Khanna Publishing House, Delhi.
6. Craig, J.J., "Introduction to Robotics: Mechanics and Control", Pearson, New Delhi, 2009
7. Mark W. Spong, Seth Hutchinson, and M. Vidyasagar, "Robot Modelling and Control", John Wiley and Sons Inc, 2005
8. Steve Heath, "Embedded System Design", 2nd Edition, Newnes, Burlington, 2003
9. Merzouki R., Samantaray A.K., Phathak P.M. and Bouamama B. Ould, "Intelligent Mechatronic System: Modeling, Control and Diagnosis", Springer.

Course Outcomes:

After the completion of this course, the students will be able to:

1. Understand robot mechanism
2. Perform kinematic and dynamic analyses with simulation
3. Design control laws for a robot
4. Integrate mechanical and electrical hardware for a real prototype of robotic device
5. Select a robotic system for given application

AG703(A) Mobile Application Development

Course Objective: To help the students to gain a basic understanding of Android application development.

Unit I Introduction to Android: The Android Platform, Android SDK, Eclipse Installation, Android Installation, Building your First Android application, Understanding Anatomy of Android Application, Android Manifest file.

Unit II Android Application Design Essentials: Anatomy of an Android applications, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions.

Unit III Android User Interface Design Essentials: User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation.

Unit IV Testing Android applications: Publishing Android application, Using Android preferences, Managing Application resources in a hierarchy, working with different types of resources.

Unit V Using Common Android APIs: Using Android Data and Storage APIs, Managing data using SQLite, Sharing Data between Applications with Content Providers, Using Android Networking APIs, Using Android Web APIs, Using Android Telephony APIs, Deploying Android Application to the World.

References:

1. Lauren Darcey and Shane Conder, “Android Wireless Application Development”, Pearson Education, 2nd ed. (2011)
2. Reto Meier, “Professional Android 2 Application Development”, Wiley India Pvt Ltd
3. Mark L Murphy, “Beginning Android”, Wiley India Pvt Ltd
- 3.R3. Android Application Development All in one for Dummies by Barry Burd, Edition: I

Course Outcomes:

After the completion of this course, the students will be able to:

1. Identify various concepts of mobile programming that make it unique from programming for other platforms.
2. Critique mobile applications on their design pros and cons.
3. Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces.
4. Program mobile applications for the Android operating system that use basic and advanced phone features.
5. Deploy applications to the Android marketplace for distribution.

AG703(B) Entrepreneurship Development

Course Objective: The aim of the course is to motivate students to innovate in business. Students will be introduced to the entrepreneurship process

Unit I Entrepreneurship: Importance, characteristics of successful entrepreneurs, Economic impact of entrepreneurial firms on society and country, Entrepreneurship process and identifying opportunities, finding gaps in the market place, sources of generating ideas, Techniques of generating ideas, Encouraging and protecting new ideas

Unit II Feasibility Analysis: Benefits, Feasibility check chart, product/service feasibility analysis, Industry/Target market feasibility analysis, organizational feasibility analysis, financial feasibility analysis

Business Plan: Benefits, elements, Mission statement, market analysis, SWOT Analysis, Marketing Plan, Financial Projections

Unit III Industry and Competitor Analysis: Studying Industry trends, Finding a competitive strategy and developing new, gaining competitive intelligence

Initial Ethical and Legal Issues facing a new firm: ethical and legal aspects of entrepreneurship, creating strong ethical culture, Legal issues facing a new firm, selection of the Attorney, Founder's agreement, obtaining business licenses and permits, Forms of businesses

Unit IV Financial Viability of New Ventures: Financial statements and financial analysis, working capital management and venture capital

Building a New Venture Financing and Funding: Hiring, Recruiting, selecting employees, Role of Directors, Advisors and professionals in a startup, Sources of personal financing, Debt and equity financing, venture capitalists, Business Incubators, IPO, Sources of debt financing,

Unit V Marketing issues of new venture: Mass marketing, Micro marketing, Choosing a segment and target market

Importance of Intellectual Property (IP), stages of an invention cycle, Types of IP, Process of obtaining Patents, Patent infringement, Trademarks, Copyrights, Challenges of Business growth

References:

1. Entrepreneurship in India, Deependra Sharma, Taylor and Francis Manakin Press
2. CLARK, T. – OSTERWALDER, A. – PIGNEUR, Y. Business model generation: a handbook for visionaries, game changers, and challengers. Wiley Publications
3. BESSANT, J R. – TIDD, J. Managing innovation: integrating technological, market and organizational change. Wiley Publications
4. Entrepreneurship, William Bygrave, Andrew Zacharakis, Wiley

Course Outcomes:

After the completion of this course, the students will be able to:

1. Understand characteristics of successful entrepreneurs
2. Perform product/service feasibility analysis
3. Explain Ethical and Legal Issues facing a new firm
4. Understand various sources of financing and funding a new firm
5. Understand the importance of intellectual property rights in entrepreneurship

AG703(C) Cloud Computing

Course Objective: The objective of this course is to provide students with the comprehensive and in-depth knowledge of Cloud Computing concepts, technologies, architecture and applications.

UNIT I Introduction of Grid and Cloud computing, characteristics, components, business and IT perspective, cloud services requirements, cloud models, Security in public model, public versus private clouds, Cloud computing platforms: Amazon EC2, Platform as Service: Google App Engine, Microsoft Azure, Utility Computing, Elastic Computing.

UNIT II Cloud services- SAAS, PAAS, IAAS, cloud design and implementation using SOA, conceptual cloud model, cloud stack, computing on demand, Information life cycle management, cloud analytics, information security, virtual desktop infrastructure, storage cloud.

UNIT III Virtualization technology: Definition, benefits, server virtualization, HVM, study of hypervisor, logical partitioning- LPAR, Storage virtualization, SAN, NAS, cloud server virtualization, virtualized data center.

UNIT IV Cloud security fundamentals, Vulnerability assessment tool for cloud, Privacy and Security in cloud, Cloud computing security architecture: Architectural Considerations- General Issues, Trusted Cloud computing, Secure Execution Environments and Communications, Micro- architectures; Identity Management and Access control-Identity management, Access control, Autonomic Security, Cloud computing security challenges: Virtualization security management- virtual threats, VM Security Recommendations, VM-Specific Security techniques, Secure Execution Environments and Communications in cloud.

UNIT V SOA and cloud, SOA and IAAS, cloud infrastructure benchmarks, OLAP, business intelligence, e-Business, ISV, Cloud performance monitoring commands, issues in cloud computing. QOS issues in cloud, mobile cloud computing, Inter cloud issues, Sky computing, Cloud Computing Platform, Xen Cloud Platform, Eucalyptus, OpenNebula, Nimbus, TPlatform, Apache Virtual Computing Lab (VCL), Anomaly Elastic Computing Platform.

References:

1. Dr.Kumar Saurabh, "Cloud Computing", Wiley India.
2. Ronald Krutz and Russell Dean Vines, "Cloud Security", Wiley-India.
3. Judith Hurwitz, R.Bloor, M.Kanfman, F.Halper, "Computing for Dummies", Wiley India Edition.
4. Anthony T.Velte Toby J.Velte, "Cloud Computing – A Practical Approach", TMH.
5. Barrie Sosinsky, 'Cloud Computing Bible', Wiley India.

Course Outcomes:

After the completion of this course, the students will be able to:

1. Explain the core concepts of the cloud computing paradigm
2. Demonstrate knowledge of virtualization
3. Explain the core issues of cloud computing such as security, privacy, and interoperability.
4. Choose the appropriate technologies, algorithms, and approaches for the related issues.
5. Identify problems, and explain, analyze, and evaluate various cloud computing solutions.

AG704 Python Lab

Course Objective: Enable the students to write, test, and debug Python programs and create animations using Python

Python –Overview Introduction, History, Features

Python –Environment Setup Local Environment Setup, Getting Python, Installation of Python, Use of IDE

Python –Basic Syntax Python Identifiers, Reserved Words, Lines & Indentation, Multiline Statements, Quotation in Python, Comments & other useful constructs

Python –Variables Assigning Values to Variables, Multiple Assignment, Standard Data Types

Python Numbers Python Strings, Python Lists, Python Tuples, Dictionary, DataType Conversion

Python –Basic Operators Types of Operators, Arithmetic Operators, Comparison Operators, Assignment Operators, Bitwise Operators, Logical Operators, Operator Precedence.

Python –Decision Making & Loops Flowchart, If statement Syntax

Python-Functions Syntax for defining a function, Calling a Function, Function Arguments, Anonymous Functions Python-Applications & Further Extensions

Python for creating Animations- Turtle programming in Python, An introduction to creating animations with Plotly in Python, Animation in Matplotlib

References:

1. Python Crash Course: A Hands-On, Project-Based Introduction to Programming, by Eric Matthes, No Starch Press
2. Learn Python the Hard Way' by Zed A. Shaw (3rd Edition), Addison Wesley
3. Head-First Python, by Paul Barry, O'Reilly
4. 'Python Programming' by John Zelle, Franklin, Beedle & Associates Inc;

Course Outcomes:

Upon completion of this course, students will be able to

1. Install Python and have knowledge of syntax of Python
2. Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries in Python
3. Express different Decision Making statements and Functions
4. Develop code in Python using functions, loops etc.
5. Design GUI Applications in Python and evaluate different database operations

AG705 Mobile Application Development Lab

Course Objective: Enable the students to develop mobile applications

Introduction: About Android, Pre-requisites to learn Android, Dalvik Virtual Machine & .apk file extension, Android API levels (versions & version names)

Android Java Basics: Getting started with Android development, project folder structure, simple programming, running project, generating build/APK of the app from Android Studio

First application: Creating Android Project, Android Virtual Device Creation, Set up debugging environment, Workspace set up for development, Launching emulator, debugging on mobile devices.

Basic UI design: Basics about Views, Layouts, Drawable Resources, Input controls, Input Events, Toasts.

More UI Components: Layouts – GridView and ListView, Action bar, Adapters, Menus: Option menu, context menu, sub menu, Pickers – Date and Time, Spinners.

Activity and Fragment: Activity, Fragment, Activity Lifecycle and Fragment Lifecycle.

Intents: Implicit Intents, Explicit intents, communicating data among Activities.

Navigation Drawer: Panel that displays the app's main navigation screens on the left edge of the screen

Android Notifications – Toast, Dialogs (TimePicker, DatePicker, Progress, Alert), Notification Manager and Push Notification

Introducing SQLite – SQLiteOpenHelper and creating a database – Opening and closing a database, Working with cursors Inserts, updates, and deletes

References:

1. Head first Android Development.
2. Android Programming: Pushing the Limits, Wiley By Erik Hellman
3. Android Application Development Black Book, Dreamtech Press, Pradeep Kothari, KLSI

Course Outcomes:

Upon completion of this course, students will be able to-

1. Understand the basics of Android development
2. Set up the mobile app development environment
3. Understand the app idea and design user interface/wireframes of mobile app
4. Create mobile application