

# **SEMESTER**

# **VIII**

# GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

## SEMESTER VIII

Name of Department: - Computer Science and Engineering

1. Subject Code: **TCS 881** Course Title: **Advance Computer Vision**
2. Contact Hours: L: **3** T: **0** P: **0**
3. Examination Duration (Hrs): **Theory 3 Practical 0**
4. Relative Weight: **CIE 25 MSE 25 ESE 50**
5. Credits: **3**
6. Semester: **VIII**
7. Category of Course: **DSC**
8. Pre-requisite: Data Structures with C (TCS 301), Image processing and computer vision (TCS691)

9. Course Outcome:	<p>After completion of the course the students will be able to:</p> <p>CO1 Understand the principals the computer vision and image processing used to describe features of images.</p> <p>CO2 Understand the mathematical foundations for digital manipulation of images</p> <p>CO3 Design, code and test computer applications using MATLAB/OpenCV.</p> <p>CO4 Analyse a wide range of problems and provide solutions related to the design of computer applications through suitable algorithms, structures, diagrams, and other appropriate methods.</p> <p>CO5 Plan and undertake major individual computer applications.</p> <p>CO6 Write programs in MATLAB/OpenCV For digital manipulation of images; image acquisition; pre-processing; segmentation.</p>
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### 10. Details of the Course:

S. No.	Contents	Contact Hours
1	<b>Unit 1:</b> Image Processing Techniques: Image Enhancement: Histogram Processing, Smoothing filters, Sharpening filters; Image restoration, Image Compression– coding Redundancy, spatial and temporal redundancy, Compression models Segmentation: Segmentation concepts, point, line and Edge detection, Thresholding,	9

	region-based segmentation.	
2	<b>Unit 2:</b> Edge detection, Thresholding, Region growing, Fuzzy clustering, Watershed algorithm, Active contour models, Texture feature-based segmentation, Graph based segmentation, Applications of image segmentation. Background Subtraction in Videos, Morphological processing,	9
3	<b>Unit 3:</b> Image content Analysis: Feature mapping using the scale-invariant feature transform (SIFT) algorithm, Image registration, Image classification, Object Localization, Object Recognition, Object Detection, Object recognition, shape from shading, foreground-background separation.	10
4	<b>Unit 4:</b> Motion Estimation: Optical flow, general methodologies, pixel-based motion estimation, Block matching algorithm, Mesh based motion Estimation, global Motion Estimation, Region based motion estimation, multi resolution motion estimation. Waveform based coding, Block based transform coding, predictive coding, Application of motion estimation in video coding.	9
5	<b>Unit 5:</b> Introduction to deep learning, deep learning techniques, CNN: Architectures, Convolution, Pooling Layers, Transfer Learning, Applications: Image classification using Convolutional Neural Networks (CNNs), Anomaly detection using Convolutional Neural Networks (CNNs), medical image-fusion using deep learning method, Image Captioning.	9
	<b>Total</b>	46

#### Text Books:

Authors Name	Title	Edition	Publisher, Country	Year
R. C. Gonzalez, R. E. Woods and S. L. Eddins	Digital Image Processing	4 <sup>th</sup> Edition	Pearson.	2017
R. C. Gonzalez, R. E. Woods and S. L. Eddins , Publisher:	Digital Image Processing using Matlab	2 <sup>nd</sup> Edition	Pearson	2017
Rajalingappaa Shanmugamani,	Deep Learning for	1 <sup>st</sup> Edition	O Reilly	2018

	Computer Vision			
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### Reference Books:

Authors Name	Title	Edition	Publisher, Country	Year
Antonio Gulli, Sujit Pal	Deep Learning with Keras	1 <sup>st</sup> Edition	O Reilly	2017
Jan Salem	Programming Computer Vision with Python	1 <sup>st</sup> Edition	O Reilly	2012

### Course Articulation Matrix

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
TCS881.1	Understand the principals the computer vision and image processing used to describe features of images.	2	-	1	-	-	-	-	-	-	-	-	1	1	2	1
TCS881.2	Understand the mathematical foundations for digital manipulation of images	2	-	1	3	-	-	-	-	-	-	-	1	1	2	1
TCS881.3	Design, code and test computer applications using MATLAB/OpenCV.	-	-	3	-	3	-	-	-	-	-	2	3	3	2	2
TCS881.4	Analyse a wide range of problems and provide solutions related to the design of computer applications through suitable algorithms, structures, diagrams, and other appropriate methods.	-	3	-	2	-	-	-	-	-	-	-	2	2	1	1
TCS881.5	Plan and undertake major individual computer applications.	2	-	-	1	-	-	-	-	-	-	-	1	2	1	1
TCS881.6	Write programs in MATLAB/OpenCV.for digital manipulation of images; image acquisition; pre-processing; segmentation.	1	-	-	-	3	-	-	-	-	-	-	2	2	1	1
<b>TCS 881</b>		<b>1.75</b>	<b>3</b>	<b>1.66</b>	<b>2</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>1.66</b>	<b>1.83</b>	<b>1.5</b>	<b>1.16</b>

High correlation (3); Medium correlation (2); Low correlation (1), No correlation ( - )

# GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

## SEMESTER VIII

Name of Department: - Computer Science and Engineering

1. Subject Code: **TCS 859** Course Title: **Service oriented Cloud**
2. Contact Hours: L: **3** T: **0** P: **0**
3. Examination Duration (Hrs): Theory **3** Practical **0**
4. Relative Weight: CIE **25** MSE **25** ESE **50**
5. Credits: **3**
6. Semester: **VIII**
7. Category of Course: **DSC**
8. Pre-requisite: Virtualization and Cloud Computing (TCS451), Cloud Based Application Development and Management (TCS552)

9. Course Outcome:	<p>After completion of the course the students will be able to:</p> <p>CO1 Identify the concept of service-oriented cloud architecture.</p> <p>CO2 Demonstrate micro services architecture and services-oriented cloud architecture protocols with security aspects.</p> <p>CO3 Analyse the service-oriented cloud architecture for business technology and policy management.</p> <p>CO4 Apply digital age technologies in services-oriented cloud architecture-based cloud applications.</p> <p>CO5 Evaluate the performance of services-oriented cloud architecture governance framework and their legacy evolution.</p> <p>CO6 Design a server less cloud-based web application and deploy as a Micro service on OpenShift and as static files on Cloud Object Storage.</p>
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### 10. Details of the Course:

S. NO.	Contents	Contact Hours
1	<b>Unit - I</b> Services oriented cloud architecture: Defining concepts, Principles, Patterns, Importance, components, working, limitations, Enterprise Service Bus (ESB) in service-oriented cloud architecture, Benefits of ESB, Interfaces and namespaces, SOLID principles, IoC containers, Case study of service-oriented	9

	cloud architectures.	
<b>2</b>	<b>Unit – II</b> Micro services architecture, Services oriented cloud architecture protocols, Security, Full stack cloud applications, Distributed applications and Web services. Technologies and frameworks for distributed and server-side application development, Service-oriented cloud architecture communications, Case study of service-oriented cloud architecture protocols and communications.	<b>9</b>
<b>3</b>	<b>Unit – III</b> Services oriented cloud architecture for Business Technology, Cloud service accessibility, cloud service visibility, cloud service extensibility, Cloud service SLAs, cloud service deployment using contract-management techniques, Policy management techniques, Case study of service-oriented cloud architecture for business policy management.	<b>9</b>
<b>4</b>	<b>Unit – IV</b> Services oriented cloud architecture in the Digital Age, designing domain specific cloud services, Service-oriented distributed applications, Semantic web and web services, RESTful, AJAX, JSON, Web API, Web Socket application in cloud services, Open Standards Landscape around Architecture, Develop an application on Cloud leveraging cloud services like AI-powered APIs and NoSQL databases, Case study of service oriented cloud architecture in digital age applications.	<b>9</b>
<b>5</b>	<b>Unit – V</b> Services oriented cloud architecture governance framework, Legacy evolution, Services oriented cloud reference architecture, Windows communication foundation services (WCF), Hosting and consuming WCF services, evaluating performance of WCF services in cloud platform, Serverless computing, Create a serverless cloud based web application and deploy as a Microservice on OpenShift and as static files on Cloud Object Storage, Case study of service oriented cloud architecture for business governance.	<b>9</b>
	<b>Total</b>	<b>45</b>

**Text Books:**

Authors Name	Title	Edition	Publisher, Country	Year
Barrie Sosinsky	Cloud Computing Bible	1 <sup>st</sup> Edition	Wiley	2011
H. Peter Alesso, Craig F. Smith	Thinking On the Web: Berners-Lee, Godel And Turing: Berners-Lee, Gödel, and Turing	1 <sup>st</sup> Edition	Wiley-Interscience	2008
Peter Mika	Social Networks and the Semantic Web: 5 (Semantic Web and Beyond)	1 <sup>st</sup> Edition	Springer-Verlag New York Inc.	2010

**Reference Books:**

Authors Name	Title	Edition	Publisher, Country	Year
Thomas Erl, Ricardo Puttin, Zaigham Mahmood	Cloud Computing: Concepts, Technology & Architecture	1 <sup>st</sup> Edition	PHI	2013
David S. Linthicum	Cloud Computing and SOA Convergence in Your Enterprise: A Step-by-Step Guide	1 <sup>st</sup> Edition	Addison Wesley	2009



### Course Articulation Matrix

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
TCS859.1	Identify the concept of service-oriented cloud architecture.	1	1	-	1	-	-	-	-	-	-	-	1	2	1	1
TCS859.2	Demonstrate micro services architecture and services-oriented cloud architecture protocols with security aspects.	2	-	2	-	-	-	-	-	-	-	-	2	2	1	1
TCS859.3	Analyse the service-oriented cloud architecture for business technology and policy management.	-	3	-	-	-	-	-	-	-	-	-	1	3	2	1
TCS859.4	Apply digital age technologies in services-oriented cloud architecture-based cloud applications.	2	-	3	-	3	-	-	-	-	-	-	-	3	1	1
TCS6859.5	Evaluate the performance of services-oriented cloud architecture governance framework and their legacy evolution.	2	-	1	1	2	-	-	-	-	-	-	-	1	2	3
TCS859.6	Design a server less cloud-based web application and deploy as a Micro service on OpenShift and as static files on Cloud Object Storage.	-	1	3	-	-	-	-	-	-	-	-	2	3	2	2
<b>TCS 859</b>		1.75	1.66	2.25	1	2.5	-	-	-	-	-	-	1.5	2.33	1.5	1.5

High correlation (3); Medium correlation (2); Low correlation (1), No correlation ( - )

# GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

## SEMESTER VIII

Name of Department: - Computer Science and Engineering

1. Subject Code: **TCS 801** Course Title: **Mobile Computing**
2. Contact Hours: L: **3** T: **0** P: **0**
3. Examination Duration (Hrs): Theory **3** Practical **0**
4. Relative Weight: CIE **25** MSE **25** ESE **50**
5. Credits: **3**
6. Semester: **VIII**
7. Category of Course: **DSC**
8. Pre-requisite: Communication models and Protocols (TCS 53), Computer Networks (TCS 604), Network Programming and Wireless Technologies (TCS 631)

9. Course Outcome:	<p>After completion of the course the students will be able to:</p> <p>CO1: Exemplify the concepts, techniques, protocols and architecture employed in wireless local area networks, cellular networks, and Adhoc Networks based on the standards</p> <p>CO2: Describe and analyse the network infrastructure requirements to support mobile devices and users.</p> <p>CO3: Design and implement mobile applications to realize location-aware computing</p> <p>CO4: Asses the important issues and concerns on security and Data management</p> <p>CO5: Development of various scenarios for mobile computing systems.</p> <p>CO6: Evaluate the concepts of mobile agents and mobile Adhoc algorithms with the help of NS2.</p>
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### 10. Details of the Course:

S.No.	Contents	Contact Hours
1	<b>Unit 1:</b> Introduction, issues in mobile computing, overview of wireless telephony: cellular concept, GSM: air-interface, channel structure, location management: HLR-VLR, hierarchical, handoffs, channel allocation in cellular systems, CDMA, GPRS	9

2	<b>Unit 2:</b> Wireless Networking, Wireless LAN Overview: MAC issues, IEEE 802.11, Blue Tooth, Wireless multiple access protocols, TCP over wireless, Wireless applications, data broadcasting, Mobile IP, WAP: Architecture, protocol stack, application environment, applications.	8
3	<b>Unit 3:</b> Data management issues, data replication for mobile computers, adaptive clustering for mobile wireless networks, File system, Disconnected operations	9
4	<b>Unit 4:</b> Mobile Agents computing, security and fault tolerance, transaction processing in mobile computing environment.	8
5	<b>Unit 5:</b> Ad Hoc networks, localization, MAC issues, Routing protocols, global state routing (GSR), Destination sequenced distance vector routing (DSDV), Dynamic source routing (DSR), Ad Hoc on demand distance vector routing (AODV), Temporary ordered routing algorithm (TORA), QoS in Ad Hoc Networks, applications	9
	<b>Total</b>	45

#### Textbooks:

Authors Name	Title	Edition	Publisher, Country	Year
J. Schiller	Mobile Communications	2 <sup>nd</sup> Edition	Addison Wesley.	2008
Asha Mehrotra	GSM System Engineering (Mobile Communications Library)	1 <sup>st</sup> Edition	Artech House Publishers	1997
Marcus Taylor, Marcel Van Der Heijden	Understanding WAP: Wireless Applications, Devices and Services	Unabridged	Artech House Publishers	2000

**Reference Books:**

Authors Name	Title	Edition	Publisher, Country	Year
J. Schiller	Mobile Communications	2 <sup>nd</sup> Edition	Addison Wesley.	2008
Asha Mehrotra	GSM System Engineering (Mobile Communications Library)	1 <sup>st</sup> Edition	Artech House Publishers	1997
Marcus Taylor, Marcel Van Der Heijden	Understanding WAP: Wireless Applications, Devices and Services	Unabridged	Artech House Publishers	2000

### Course Articulation Matrix

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
TCS801.1	Exemplify the concepts, techniques, protocols and architecture employed in wireless local area networks, cellular networks, and Adhoc Networks based on the standards	2	2	-	-	-	-	-	2	1	2	1	3	-	-	2
TCS801.2	CO2 Describe and analyse the network infrastructure requirements to support mobile devices and users.	1	3	-	-	1	-	-	1	1	2	1	2	-	2	-
TCS801.3	Design and implement mobile applications to realize location-aware computing	1	2	1	2	1	-	-	1	2	1	1	2	-	2	-
TCS801.4	Asses the important issues and concerns on security and Data management	2	2	1	2	-	-	-	-	2	2	2	2	-	1	2
TCS801.5	Development of various scenarios for mobile computing systems	1	1		2	1	-	-	2	1	2	1	1	1	2	-
TCS801.6	Evaluate the concepts of mobile agents and mobile Adhoc algorithms with the help of NS2	2	2	3	-	-	-	-	-	2	2	1	1	-	2	1
<b>TCS 801</b>		<b>1.5</b>	<b>2</b>	<b>1.66</b>	<b>2</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>1.5</b>	<b>1.5</b>	<b>1.83</b>	<b>1.16</b>	<b>1.83</b>	<b>1</b>	<b>1.8</b>	<b>1.66</b>

High correlation (3); Medium correlation (2); Low correlation (1), No correlation ( - )

# GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

## SEMESTER VIII

Name of Department: - Computer Science and Engineering

1. Subject Code: **TCS 821** Course Title: **Soft Computing**
2. Contact Hours: L: **3** T: **0** P: **0**
3. Examination Duration (Hrs): Theory **3** Practical **0**
4. Relative Weight: CIE **25** MSE **25** ESE **50**
5. Credits: **3**
6. Semester: **VIII**
7. Category of Course: **DSC**
8. Pre-requisite: Artificial Intelligence: Search Methods for Problem Solving (TCS561)

9. Course Outcome:	After completion of the course the students will be able to:  CO1: Summarize about soft computing techniques and their applications  CO2: Analyse various neural network architectures  CO3: Design perceptron and counter propagation networks.  CO4: Classify the fuzzy systems  CO5: Analyse the genetic algorithms and their applications.  CO6: Compose the fuzzy rules.
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### 10. Details of the Course:

S. NO.	Contents	Contact Hours
1	<b>Unit 1:</b> Fundamentals of ANN: The Biological Neural Network, Artificial Neural Networks -Building Blocks of ANN and ANN terminologies: architecture, setting of weights, activation functions - McCulloch-pitts Neuron Model, Hebbian Learning rule, Perception learning rule, Delta learning rule.	9
2	<b>Unit 2:</b> Models of ANN: Single layer perception, Architecture, Algorithm, application procedure- Feedback Networks: Hopfield Net and BAM - Feed Forward Networks: Back Propagation Network (BPN) and Radial Basis Function Network (RBFN) –Self Organizing Feature Maps: SOM and LVQ	9

3	<b>Unit 3:</b> Fuzzy Sets, properties and operations - Fuzzy relations, cardinality, operations and properties of fuzzy relations, fuzzy composition.	9
4	<b>Unit 4:</b> Fuzzy variables - Types of membership functions - fuzzy rules: Takagi and Mamdani –fuzzy inference systems: fuzzification, inference, rulebase, defuzzification.	9
5	<b>Unit 5:</b> Genetic Algorithm (GA): Biological terminology – elements of GA: encoding, types of selection, types of crossover, mutation, reinsertion – a simple genetic algorithm – Theoretical foundation: schema, fundamental theorem of GA, building block hypothesis.	9
	<b>Total</b>	45

#### Textbooks:

Authors Name	Title	Edition	Publisher, Country	Year
S. N. Sivanandam, S. Sumathi, S.N. Deepa	Introduction to Neural Networks using MATLAB 6.0	1 <sup>st</sup> Edition	McGraw Hill Education	2017
S. N. Sivanandam, S.N. Deepa,	Principles of Soft Computing	2 <sup>nd</sup> Edition	Wiley	2011
Goldberg	Genetic Algorithms In Search, Optimization And Machine Learning	1 <sup>st</sup> Edition	Pearson Education India	2008

### Course Articulation Matrix

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
TCS821.1	Summarize about soft computing techniques and their applications	3	-	-	-	-	-	-	-	-	1	-	2	3	1	1
TCS821.2	Analyse various neural network architectures	-	3	-	-	-	-	-	-	-	-	-	1	2	2	1
TCS821.3	Design perceptron and counter propagation networks.	-	-	3	1	-	-	-	-	-	-	-	1	2	2	2
TCS821.4	Classify the fuzzy systems	2	-	-	1	-	-	-	-	-	-	-	-	2	1	1
TCS821.5	Analyse the genetic algorithms and their applications.	-	3	-	-	-	-	-	-	-	-	-	1	2	2	1
TCS821.6	Compose the fuzzy rules.	-	2	-	-	-	-	-	-	-	2	-	2	1	1	1
<b>TCS 821</b>		<b>2.5</b>	<b>2.66</b>	<b>3</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>1.5</b>	<b>-</b>	<b>1.4</b>	<b>2</b>	<b>1.5</b>	<b>1.16</b>

High correlation (3); Medium correlation (2); Low correlation (1), No correlation ( - )



# GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

## SEMESTER VIII

Name of Department: - Computer Science and Engineering

1. Subject Code: **TCS 822** Course Title: **Mobile Application**
2. Contact Hours: L: **3** T: **0** P: **0**
3. Examination Duration (Hrs): **Theory 3** **Practical 0**
4. Relative Weight: **CIE 25** **MSE 25** **ESE 50**
5. Credits: **3**
6. Semester: **VIII**
7. Category of Course: **DSC**
8. Pre-requisite: Computer Networks (TCS604), Full Stack Web Development (TCS 693)

9. Course Outcome:	After completion of the course the students will be able to: CO1 Understand and apply the key technological principles and methods for delivering and maintaining mobile applications CO2 Evaluate and contrast requirements for mobile platforms to establish appropriate strategies for development and deployment CO3 Develop and apply current standard-compliant scripting/programming techniques for the successful deployment of mobile applications targeting a variety of platforms CO4 Carry out appropriate formative and summative evaluation and testing utilising a range of mobile platforms CO5 Interpret a scenario, plan, design and develop a prototype hybrid and native mobile application CO6 Investigate the leading-edge developments in mobile application development and use these to inform the design process.
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### 10. Details of the Course:

S. NO.	Contents	Contact Hours
1	<b>Unit 1:</b> <b>Getting started with Mobility</b> Mobility landscape, Mobile platforms, Mobile apps development, Overview of Android platform, setting up the mobile app development environment along with an emulator,	9

	a case study on Mobile app development	
2	<b>Unit 2:</b> <b>Building blocks of mobile apps</b> App user interface designing – mobile UI resources (Layout, UI elements, Draw-able, Menu), Activity- states and life cycle, interaction amongst activities. App functionality beyond user interface - Threads, Async task, Services – states and life cycle, Notifications, Broadcast receivers, Telephony and SMS APIs Native data handling – on-device file I/O, shared preferences, mobile databases such as SQLite, and enterprise data access (via Internet/Intranet)	9
3	<b>Unit 3:</b> <b>Sprucing up mobile apps</b> Graphics and animation – custom views, canvas, animation APIs, multimedia – audio/video playback and record, location awareness, and native hardware access (sensors such as accelerometer and gyroscope)	9
4	<b>Unit 4:</b> <b>Testing mobile apps</b> Debugging mobile apps, White box testing, Black box testing, and test automation of mobile apps, JUnit for Android, Robotium, Monkey Talk	9
5	<b>Unit 5:</b> <b>Taking apps to Market</b> Versioning, signing and packaging mobile apps, distributing apps on mobile marketplace	9
	<b>Total</b>	45

#### Textbooks:

Authors Name	Title	Edition	Publisher, Country	Year
Jeff McWherter, Scott Gowell	Professional Mobile Application Development	1 <sup>st</sup> Edition	Wrox	2012
Pradeep Kothari	Android Application Development (With KitKat Support), Black Book	1 <sup>st</sup> Edition	Dreamtech Press	2014

### Course Articulation Matrix

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
TCS822.1	Understand and apply the key technological principles and methods for delivering and maintaining mobile applications	2	-	1	-	-	-	-	-	-	-	-	1	1	2	1
TCS822.2	Evaluate and contrast requirements for mobile platforms to establish appropriate strategies for development and deployment	2	-	-	1	2	-	-	-	-	-	-	2	1	2	3
TCS822.3	Develop and apply current standard-compliant scripting/programming techniques for the successful deployment of mobile applications targeting a variety of platforms	1	-	3	-	3	-	-	-	-	-	-	3	3	2	1
TCS822.4	Carry out appropriate formative and summative evaluation and testing utilising a range of mobile platforms	2	1	3	-	2	-	-	-	-	-	-	2	3	1	1
TCS822.5	Interpret a scenario, plan, design and develop a prototype hybrid and native mobile application	-	1	3	-	-	-	-	-	-	-	-	2	3	2	1
TCS822.6	Investigate the leading-edge developments in mobile application development and use these to inform the design process	2	3	-	2	-	-	-	-	-	-	2	2	2	2	1
<b>TCS 822</b>		<b>1.8</b>	<b>1.66</b>	<b>2.5</b>	<b>1.5</b>	<b>2.33</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>2</b>	<b>2.16</b>	<b>1.83</b>	<b>1.33</b>

High correlation (3); Medium correlation (2); Low correlation (1), No correlation (-)

# GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

## SEMESTER VIII

Name of Department: - Computer Science and Engineering

1.	Subject Code:	<b>TCS 823</b>	Course Title:	<b>Multimedia Systems and Data</b>
2.	Contact Hours:	L: <b>3</b>	T: <b>0</b>	P: <b>0</b>
3.	Examination Duration (Hrs):	<b>Theory 3</b>	<b>Practical 0</b>	
4.	Relative Weight:	<b>CIE 25</b>	<b>MSE 25</b>	<b>ESE 50</b>
5.	Credits:	<b>3</b>		
6.	Semester:	<b>VIII</b>		
7.	Category of Course:	<b>DSC</b>		
8.	Pre-requisite:	Logic Design and Computer Organization (TCS 308)		

9. Course Outcome:	<p>After completion of the course the students will be able to:</p> <p>CO1 Demonstrate the basic concept of multimedia information representation. Delve into the requirement of multimedia communication in today's digital world.</p> <p>CO2 Compare circuit mode and packet mode. Explain QoS and its applications.</p> <p>CO3 Summarize the various multimedia information representations</p> <p>CO4 Compute Arithmetic, Huffman, Lempel –Ziv and Lempel–Ziv Welsh coding. Summarize Joint Photographic Expert Group (JPEG).</p> <p>CO5 Differentiate between the audio compression techniques: PCM, DPCM, ADPCM, LPC, CELPC and MPEG. Differentiate MPEG1, MPEG2 and MPEG4.</p> <p>CO6 Construct Haptic Interfaces and Virtual reality Systems</p>
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### 10. Details of the Course:

S. No.	Contents	Contact Hours
1	<b>Unit. I</b> Introduction to Multimedia Presentation and Production, Multisensory Perception, Digital Representation of Data: Why it is required, Analog to Digital Conversion and Digital to Analog Conversion, Nyquist's Theorem, Relation between Sampling Rate and Bit Depth, Quantization Error, Fourier Representation, Pulse Modulation Describing Multimedia Presentations: SMIL	10

	Text: Typeface, Fonts; Tracking, Kerning, Spacing; Optical Character Recognition; Unicode Standard; Text to Voice	
2	<b>Unit. II</b> Data Compression: Approaches to compression, Basic Techniques: Run-Length Encoding; Statistical Methods: Information Theory Concepts, Variable-Size codes, Shannon-Fano coding, Huffman coding, Adaptive Huffman Coding, Arithmetic Coding; Dictionary Methods: LZ77(Sliding Window), LZ78, LZW; Various LZ Applications, Deflate: zip and Gzip, LZMA and 7-zip.	9
3	<b>Unit. III</b> Image types, how we see color, Vector and Bitmap, Color Models: RGB, CMYK, Lab, HSL, HSB/HSV, YUV, conversion between different color models; Basic steps of image processing, Scanner, Digital Camera, Gamma Correction, General Study of the following image formats: BMP, TIF, PNG, GIF, SVG Image Compression: Approaches, Image Transforms, The Discrete Cosine Transform, Detailed study of JPEG, JPEG-LS, Progressive image compression, JBIG	9
4	<b>Unit – IV</b> Acoustics and the Nature of Sound Waves, Fundamental Characteristics of Sound, Musical Note, Pitch, Beat, Rhythm, Melody, Harmony and Tempo; Elements of Audio Systems, General study of Microphone, Amplifier, Loudspeaker, Mixer; Digital Audio, Synthesizers, MIDI, MIDI Connections, MIDI messages, Staff Notation, Sound Card, Audio Codecs: AIFF, WAV, Apple Lossless, Dolby TrueHD, DTS-HD Master Audio, FLAC, WMA, Audio Playing Software, Audio Recording using Dolby, Dolby Digital and Dolby Digital Surround EX, Voice Recognition Video: Analog Video, Transmission of Video Signals, Chroma Sub sampling, Composite and Components Video, NTSC, PAL and SECAM, Digital Video, High-Definition TV, Video Recording Formats; Video Compression, MPEG, MPEG-4; General Study of the following formats and codecs: avi, flv, m4v	9
5	<b>Unit – V</b> Multimedia Messaging Service (MMS): MMS standard, MMS Architecture, An Engineering perspective on How a MMS is created, sent and retrieved Introduction to Virtual Reality: Components of a VR System, Haptic Interfaces, Virtual Reality Programming, Impact of Virtual Reality, Case study of Second Life	8
	<b>Total</b>	45

**Textbooks:**

Authors Name	Title	Edition	Publisher, Country	Year
Ranjan Parekh	Principles of Multimedia	2 <sup>nd</sup> Edition	McGraw Hill,	2006

**Reference Books:**

Authors Name	Title	Edition	Publisher, Country	Year
David Salomon	Data Compression: The Complete Reference	4 <sup>th</sup> Edition	Springer Books	2003
Grigore Burdea, Philippe Coiffet	Virtual reality technology, Volume 1	2 <sup>nd</sup> Edition	Wiley	2003

### Course Articulation Matrix

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
TCS823.1	Demonstrate the basic concept of multimedia information representation. Delve into the requirement of multimedia communication in today's digital world.	3														
TCS823.2	Compare circuit mode and packet mode. Explain QoS and its applications.		3													
TCS823.3	Summarize the various multimedia information representations		2													
TCS823.4	Compute Arithmetic, Huffman, Lempel –Ziv and Lempel–Ziv Welsh coding. Summarize Joint Photographic Expert Group (JPEG).				3											
TCS823.5	Differentiate between the audio compression techniques: PCM, DPCM, ADPCM, LPC, CELPC and MPEG. Differentiate MPEG1, MPEG2 and MPEG4.															
TCS823.6	Construct Haptic Interfaces and Virtual reality Systems															
<b>TCS 823</b>																

High correlation (3); Medium correlation (2); Low correlation (1), No correlation ( - )

# GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

## SEMESTER VIII

Name of Department: - Computer Science and Engineering

1. Subject Code: **TCS 826** Course Title: **UNIX Systems**
2. Contact Hours: L: **3** T: **0** P: **0**
3. Examination Duration (Hrs): Theory **3** Practical **0**
4. Relative Weight: CIE **25** MSE **25** ESE **50**
5. Credits: **3**
6. Semester: **VIII**
7. Category of Course: **DSC**
8. Pre-requisite: Data Structures with C (TCS-302), Operating Systems (TCS-502), Design and Analysis of Algorithms (TCS409)

9. Course Outcome:	After completion of the course the students will be able to:  CO1: Experiment with various system calls CO2: Compare between ANSI C AND C++ AND POSIX standards CO3: Mapping the relationship between UNIX Kernel support for files CO4: Use Kernel support for process creation and termination and memory allocation CO5: Analyze Process Accounting process UID ,Terminal logins, network logins CO6: Analyze process control, Daemon characteristics, coding rules and error logging
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### 10. Details of the Course:

S. No.	Contents	Contact Hours
1	<b>Unit 1:</b> Introduction to System Programming, File I/O, Difference between Buffered and Unbuffered I/O, I/O system calls: open(), close(), read(), write(), Effect of I/O buffering in stdio and the kernel; synchronized I/O, Seeking to a file offset: lseek(), File control: fcntl(), Locking, Open file status flags, Open files and file descriptors, Duplicating file descriptors with dup, dup2 and fcntl. A brief recap of Buffered I/O, Forays into Advanced I/O	9
2	<b>Unit 2:</b>	10



	Processes: Process ID and Parent process ID, Memory layout, Running and Terminating a process, Waiting for Terminated child processes (fork, the exec family, wait, waitpid), copy on write, Advanced Process Management: Process Priorities, nice(), Setting the scheduling policy	
3	<b>Unit 3:</b> Processes and Inter-Process Communication: Introduction, pipes, FIFOs, XSI IPC: Message Queues, Semaphores, Shared Memory	9
4	<b>Unit 4:</b> Signals: Signal types and default actions, Basic Signal management, signal function, unreliable signals, SIGCLD, sending signals, Signal sets, Blocking signals (the signal mask), Interruption and restarting of system calls, Designing signal handlers	8
5	<b>Unit 5:</b> Network Programming: Sockets, Operation, Socket types, Client/Server Models, Connection Based Services, Handling Out of Band Data, Connectionless Services, Design issues of Concurrent and iterative servers, Socket options	9
	<b>Total</b>	45

#### Textbooks:

Authors Name	Title	Edition	Publisher, Country	Year
Richard Stevens and Stephen Rago	Advanced Programming in the Unix Environment	3 <sup>rd</sup> Edition	Addison-Wesley	2013
Michael Kerrisk	The Linux Programming Interface	2 <sup>nd</sup> Edition	No Starch Press	2010

#### Reference Books:

Authors Name	Title	Edition	Publisher, Country	Year
Richard Stevens and Stephen Rago	Advanced Programming in the Unix Environment	3 <sup>rd</sup> Edition	Addison-Wesley	2013
Michael Kerrisk	The Linux Programming Interface	2 <sup>nd</sup> Edition	No Starch Press	2010

**Course Articulation Matrix**

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
TCS826.1	Experiment with various system calls	-	2	-	-	-	-	-	-	-	-	-	1	2	1	1
TCS826.2	Compare between ANSI C AND C++ AND POSIX standards	1	-	2	-	2	-	-	-	-	1	-	1	2	1	1
TCS826.3	Mapping the relationship between UNIX Kernel support for files	-	2	-	-	2	-	-	-	-	-	-	2	1	1	2
TCS826.4	Use Kernel support for process creation and termination and memory allocation	1	2	-	-	-	-	-	-	-	-	-	-	1	1	2
TCS826.5	Analyze Process Accounting process UID, Terminal logins, network logins	-	3	1	2	-	-	-	-	-	-	1	1	3	1	1
TCS826.6	Analyze process control, Daemon characteristics, coding rules and error logging	-	3	1	-	-	-	-	-	-	-	1		3	1	1
<b>TCS 826</b>		<b>1</b>	<b>2.4</b>	<b>1.33</b>	<b>2</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>1</b>	<b>1.25</b>	<b>2</b>	<b>1</b>	<b>1.33</b>

High correlation (3); Medium correlation (2); Low correlation (1), No correlation ( - )

# GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

## SEMESTER VIII

Name of Department: - Computer Science and Engineering

1. Subject Code: **TCS 851** Course Title: **Storage Networks**
2. Contact Hours: L: **3** T: **0** P: **0**
3. Examination Duration (Hrs): Theory **3** Practical **0**
4. Relative Weight: CIE **25** MSE **25** ESE **50**
5. Credits: **3**
6. Semester: **VIII**
7. Category of Course: **DSC**
8. Pre-requisite: Computer Network (TCS604)

9. Course Outcome:	After completion of the course the students will be able to:  CO1: Understand the different aspects of storage management  CO2: Describe the various applications of RAID  CO3: Compare and contrast the I/O Techniques  CO4: Categorize virtualization on various levels of storage network  CO5: Estimate the various requirements of storage management systems  CO6: Design a complete data center and enhance employability in this field
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### 10. Details of the Course:

S. No.	Contents	Contact Hours
1	<b>Unit 1:</b> Introduction to Storage Technology Introduction to storage network, five pillars of IT, parameters related with storage, data proliferation, problem caused by data proliferation, Hierarchical storage management, Information life cycle management (ILM), Role of ILM, Information value vs. time mapping, Evolution of storage, Storage infrastructure component, basic storage management skills and activities, Introduction to Datacentres, Technical & Physical components for building	10

	datacentres	
2	<p><b>Unit 2:</b> Technologies for Storage network, Server centric IT architecture &amp; its limitations, Storage centric IT architecture &amp; advantages, replacing a server with storage networks, Disk subsystems, Architecture of disk subsystem, Hard disks and Internal I/O channel, JBOD, RAID&amp; RAID levels, RAID parity, comparison of RAID levels, Hot sparing, Hot swapping, Caching: acceleration of hard disk access, Intelligent Disk subsystem architecture</p> <p>Tape drives: Introduction to tape drives, Tape media, caring for Tape&amp; Tape heads, Tape drive performance, Linear tape technology, Helical scan tape technology</p>	9
3	<p><b>Unit 3:</b> I/O techniques</p> <p>I/O path from CPU to storage systems, SCSI technology – basics &amp; protocol, SCSI and storage networks, Limitations of SCSI</p> <p>Fibre channel: Fibre channel, characteristic of fibre channel, serial data transfer vs. parallel data transfer, Fibre channel protocol stack, Links, ports &amp; topologies, Data transport in fibre channel,</p> <p>Addressing in fibre channel, Designing of FC-SAN, components, Interoperability of FCSAN, FC products</p> <p>IP Storage: IP storage standards (iSCSI, iFCP, FCIP, iSNS), IPSAN products, Security in IP SAN, introduction to InfiniBand, Architecture of InfiniBand</p> <p>NAS – Evolution, elements &amp; connectivity, NAS architecture</p>	9
4	<p><b>Unit 4:</b> Storage Virtualization</p> <p>Introduction to storage virtualization, products, definition, core concepts, virtualization on various levels of storage network, advantages and disadvantages, Symmetric and asymmetric virtualization, performance of San virtualization, Scaling storage with virtualization</p>	9
5	<p><b>Unit 5:</b> Management of storage network, SNMP protocol, requirements of management systems, Management interfaces, Standardized and proprietary mechanism, In-band&amp; Out-band management, Backup and Recovery</p>	8
	<b>Total</b>	45

**Textbooks:**

Authors Name	Title	Edition	Publisher, Country	Year
R. Spalding	Storage Networks: The Complete Reference	1 <sup>st</sup> Edition	McGraw-Hill	2017
Marc Farley	Storage Networking Fundamentals: An Introduction to Storage Devices, Subsystems, Applications, Management, and File Systems	3 <sup>rd</sup> Edition	Cisco Press	2004

**Reference Books:**

Authors Name	Title	Edition	Publisher, Country	Year
R. Spalding	Storage Networks: The Complete Reference	1 <sup>st</sup> Edition	McGraw-Hill	2017
Marc Farley	Storage Networking Fundamentals: An Introduction to Storage Devices, Subsystems, Applications, Management, and File Systems	3 <sup>rd</sup> Edition	Cisco Press	2004

### Course Articulation Matrix

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
TCS851.1	Understand the different aspects of storage management	2	-	1	-	-	-	-	-	-	-	-	1	1	2	1
TCS851.2	Describe the various applications of RAID	1	-	-	-	2	1	-	-	-	-	-	1	1	2	1
TCS851.3	Compare and contrast the I/O Techniques	2	-	-	-	-	-	-	-	-	-	-	1	2	1	1
TCS851.4	Categorize virtualization on various levels of storage network	-	2	-	1	-	-	-	-	-	-	-	-	2	2	1
TCS851.5	Estimate the various requirements of storage management systems	1	-	-	3	-	-	-	-	-	-	-	-	2	1	1
TCS851.6	Design a complete data centre and enhance employability in this field	-	1	3	-	-	2	-	-	-	-	-	2	3	2	1
<b>TCS 851</b>		<b>1.5</b>	<b>1.5</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>1.5</b>	-	-	-	-	-	<b>1.25</b>	<b>1.83</b>	<b>1.66</b>	<b>1</b>

High correlation (3); Medium correlation (2); Low correlation (1), No correlation ( - )

# GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

## SEMESTER VIII

Name of Department: - Computer Science and Engineering

1. Subject Code: **TCS 852** Course Title: **Pattern Recognition**
2. Contact Hours: L: **3** T: **0** P: **0**
3. Examination Duration (Hrs): Theory **3** Practical **0**
4. Relative Weight: CIE **25** MSE **25** ESE **50**
5. Credits: **3**
6. Semester: **VIII**
7. Category of Course: **DSC**
8. Pre-requisite: Artificial Intelligence: Search Methods for Problem Solving (TCS561), PROBABILITY AND STATISTICS (TOC301)

9. Course Outcome:	<p>After completion of the course the students will be able to:</p> <p>CO1: Explain and compare a variety of pattern classification, structural pattern recognition, and pattern classifier combination techniques.</p> <p>CO2. Summarize, analyze, and relate research in the pattern recognition area verbally and in writing.</p> <p>CO3. Apply performance evaluation methods for pattern recognition, and critique comparisons of techniques made in the research literature.</p> <p>CO4. Apply pattern recognition techniques to real-world problems such as document analysis and recognition.</p> <p>CO5. Implement simple pattern classifiers, classifier combinations, and structural pattern recognizers.</p> <p>CO6. Describe the various clustering methods</p>
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### 10. Details of the Course:

S. No.	Contents	Contact Hours
1	<b>Unit 1:</b> Introduction: Machine perception, pattern recognition example, pattern recognition systems, the design cycle, learning and adaptation Bayesian Decision Theory: Introduction, continuous features – two categories' classifications, minimum error-rate classification- zero-one loss function, classifiers, discriminant functions, and decision	9

	surfaces	
2	<b>Unit 2:</b> Normal density: Univariate and multivariate density, discriminant functions for the normal density different cases, Bayes decision theory – discrete features, compound Bayesian decision theory and context Maximum likelihood and Bayesian parameter estimation: Introduction, maximum likelihood estimation, Bayesian estimation, Bayesian parameter estimation–Gaussian	9
3	<b>UNIT-3:</b> Un-supervised learning and clustering: Introduction, mixture densities and identifiability, maximum likelihood estimates, application to normal mixtures, K-means clustering. Data description and clustering – similarity measures, criteria function for clustering Component analysis: Principal component analysis, non-linear component analysis; Low dimensional representations and multi-dimensional scaling	9
4	<b>UNIT -4:</b> Discrete Hidden Markov Models: Introduction, Discrete–time Markov process, extensions to hidden Markov models, three basic problems for HMMs	9
5	<b>Unit 5:</b> Continuous hidden Markov models: Observation densities, training and testing with continuous HMMs, types of HMMs	9
	Total	<b>45</b>

**Textbooks:**

Authors Name	Title	Edition	Publisher, Country	Year
Richard O. Duda, Peter E. Hart, David G. Stroke.	Pattern Recognition	2 <sup>nd</sup> Edition	Wiley (Indian adaptation)	2021
M. Narasimha Murty, V. Susheela Devi,	Pattern Recognition	1 <sup>st</sup> Edition	Universities Press	2016

**Reference Books:**

Authors Name	Title	Edition	Publisher, Country	Year
Christopher M. Bishop, Springer	Pattern Recognition and Machine Learning	1 <sup>st</sup> Edition	Springer	2016



### Course Articulation Matrix

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
TCS852.1	Explain and compare a variety of pattern classification, structural pattern recognition, and pattern classifier combination techniques.	1	-	2	-	2	-	-	-	-	1	-	1	2	1	1
TCS852.2	Summarize, analyze, and relate research in the pattern recognition area verbally and in writing.	1	3	-	2	-	-	-	-	-	-	2	2	2	3	2
TCS852.3	Apply performance evaluation methods for pattern recognition, and critique comparisons of techniques made in the research literature.	1	-	3	2	-	-	-	-	-	-	2	2	2	1	1
TCS852.4	Apply pattern recognition techniques to real-world problems such as document analysis and recognition.	1	-	3	2	-	-	-	-	-	-	2	2	2	1	1
TCS852.5	Implement simple pattern classifiers, classifier combinations, and structural pattern recognizers.	1	-	2	3	-	-	-	-	-	-	-	2	3	2	1
TCS852.6	Describe the various clustering methods	1	-	-	-	2	1	-	-	-	-	-	1	1	2	1
<b>TCS 852</b>		<b>1</b>	<b>3</b>	<b>2.5</b>	<b>2.25</b>	<b>2</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>2</b>	<b>1.66</b>	<b>2</b>	<b>1.66</b>	<b>1.16</b>

High correlation (3); Medium correlation (2); Low correlation (1), No correlation (-)

# GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

## SEMESTER VIII

Name of Department: - Computer Science and Engineering

1. Subject Code: **TCS 855** Course Title: **Agile Software**
2. Contact Hours: L: **3** T: **0** P: **0**
3. Examination Duration (Hrs): Theory **3** Practical **0**
4. Relative Weight: CIE **25** MSE **25** ESE **50**
5. Credits: **3**
6. Semester: **VIII**
7. Category of Course: **DSC**
8. Pre-requisite: Software Engineering (TCS-611)

9. Course Outcome:	<p>After completion of the course the students will be able to:</p> <p>CO1: Describe two or more agile software development methodologies.</p> <p>CO2: Identify the benefits and pitfalls of transitioning to agile.</p> <p>CO3: Compare agile software development to traditional software development models.</p> <p>CO4: Apply agile practices such as test-driven development, stand-up meetings, and pair programming to their software engineering practices.</p> <p>CO5: Apply the agile testing</p> <p>CO6: Describe the agile in current market scenario.</p>
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### 10. Details of the Course:

S. NO.	Contents	Contact Hours
1	<b>Unit 1:</b> <b>Fundamentals of Agile:</b> The Genesis of Agile, Introduction and background, Agile Manifesto and Principles, Overview of Agile Methodologies – Scrum methodology, Extreme Programming, Feature Driven development, Design and development practices in an Agile project, Test Driven Development, Continuous Integration, Refactoring, Pair Programming, Simple Design, User Stories, Agile Testing, Agile Tools	10
2	<b>Unit 2:</b> <b>Agile Project Management:</b> Agile Scrum Methodology, Project phases, Agile Estimation,	10

	Planning game, Product backlog, Sprint backlog, Iteration planning, User story definition, Characteristics and content of user stories, Acceptance tests and Verifying stories, Agile project velocity, Burn down chart, Sprint planning and retrospective, Daily scrum, Scrum roles – Product Owner, Scrum Master, Scrum Developer, Scrum case study, Tools for Agile project management	
3	<b>Unit 3:</b> <b>Agile Software Design and Programming:</b> Agile Design Principles with UML examples, Single Responsibility Principle, Open Closed Principle, Liskov Substitution Principle, Interface Segregation Principles, Dependency Inversion Principle, Need and significance of Refactoring, Refactoring Techniques, Continuous Integration, Automated build tools, Version control, Test-Driven Development (TDD), xUnit framework and tools for TDD	9
4	<b>Unit 4:</b> <b>Agile Testing:</b> The Agile lifecycle and its impact on testing, testing user stories - acceptance tests and scenarios, Planning and managing Agile testing, Exploratory testing, Risk based testing, Regression tests, Test Automation, Tools to support the Agile tester	9
5	<b>Unit 5:</b> <b>Agile in Market:</b> Market scenario and adoption of Agile, Roles in an Agile project, Agile applicability, Agile in Distributed teams, Business benefits, Challenges in Agile, Risks and Mitigation, Agile projects on Cloud, Balancing Agility with Discipline, Agile rapid development technologies	8
	<b>Total</b>	46

**Textbooks:**

Authors Name	Title	Edition	Publisher, Country	Year
Ken Schwaber, Mike Beedle	Agile Software Development with SCRUM	1 <sup>st</sup> Edition	Pearson	2002

### Course Articulation Matrix

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
TCS855.1	Describe two or more agile software development methodologies.	1	-	-	-	2	1	-	-	-	-	-	1	1	2	1
TCS855.2	Identify the benefits and pitfalls of transitioning to agile	-	-	-	3	-	-	-	-	-	-	-	2	2	2	1
TCS855.3	Compare agile software development to traditional software development models.	1	-	2	-	2	-	-	-	-	1	-	1	2	1	1
TCS855.4	Apply agile practices such as test-driven development, stand-up meetings, and pair programming to their software engineering practices	-	2	3	-	-	-	-	-	-	-	-	2	3	2	2
TCS855.5	Apply the agile testing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TCS855.6	Describe the agile in current market scenario.	1	-	-	-	2	1	-	-	-	-	-	1	1	2	1
<b>TCS 855</b>		1	2	2.5	3	2	1	-	-	-	1	-	1.4	1.8	1.8	1.2

High correlation (3); Medium correlation (2); Low correlation (1), No correlation ( - )

# GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

## SEMESTER VIII

Name of Department: - Computer Science and Engineering

1. Subject Code: **TCS 857** Course Title: **Game Theory**
2. Contact Hours: L: **3** T: **0** P: **0**
3. Examination Duration (Hrs): Theory **3** Practical **0**
4. Relative Weight: CIE **25** MSE **25** ESE **50**
5. Credits: **3**
6. Semester: **VIII**
7. Category of Course: **DSC**
8. Pre-requisite: Artificial Intelligence: Search Methods for Problem Solving (TCS561)

9. Course Outcome:	After completion of the course the students will be able to:  CO1: Identify strategic situations and represent them as games CO2: Find dominant strategy equilibrium, pure and mixed strategy Nash equilibrium, CO3: Solve simple games using various techniques CO4: Analyze economic situations using game theoretic techniques CO5: Recommend and prescribe which strategies to implement CO6: Find the needs of extensive games.
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### 10. Details of the Course:

S. No.	Contents	Contact Hours
1	<b>Unit 1:</b> <b>Introduction, Strategic Games:</b> What is game theory? The theory of rational choice; Interacting decision makers. Strategic games; Examples: The prisoner's dilemma, Bach or Stravinsky, Matching pennies; Nash equilibrium; Examples of Nash equilibrium; Best-response functions; Dominated actions; Equilibrium in a single population: symmetric games and symmetric equilibria. <b>Mixed Strategy Equilibrium:</b> Introduction; Strategic games in which players may randomize; Mixed strategy Nash equilibrium; Dominated actions; Pure equilibria when randomization is allowed, Illustration: Expert Diagnosis; Equilibrium in a single population, Illustration: Reporting a	9

	crime; The formation of players' beliefs; Extensions; Representing preferences by expected payoffs	
2	<p><b>Unit 2:</b></p> <p><b>Extensive Games:</b> Extensive games with perfect information; Strategies and outcomes; Nash equilibrium; Subgame perfect equilibrium; Finding subgame perfect equilibria of finite horizon games: Backward induction. Illustrations: The ultimatum game, Stackelberg's model of duopoly, Buying votes.</p> <p><b>Extensive games: Extensions and Discussions:</b> Extensions: Allowing for simultaneous moves, Illustrations: Entry in to a monopolized industry, Electoral competition with strategic voters, Committee decision making, Exit from a declining industry; Allowing for exogenous uncertainty, Discussion: subgame perfect equilibrium and backward induction</p>	10
3	<p><b>Unit 3:</b></p> <p><b>Bayesian Games, Extensive Games with Imperfect Information:</b> Motivational examples; General definitions; Two examples concerning information; Illustrations: Cournot's duopoly game with imperfect information, Providing a public good, Auctions; Auctions with an arbitrary distribution of valuations.</p> <p>Extensive games with imperfect information; Strategies; Nash equilibrium; Beliefs and sequential equilibrium; Signalling games; Illustration: Strategic information transmission.</p> <p><b>Strictly Competitive Games, Evolutionary Equilibrium:</b> Strictly competitive games and maximization; Maximization and Nash equilibrium; Strictly competitive games; Maximization and Nash equilibrium in strictly competitive games.</p> <p>Evolutionary Equilibrium: Monomorphic pure strategy equilibrium; Mixed strategies and polymorphic equilibrium; Asymmetric contests; Variations on themes: Sibling behaviour, Nesting behavior of wasps, The evolution of sex ratio</p>	10
4	<p><b>Unit 4:</b></p> <p><b>Iterated Games:</b> Repeated games: The main idea; Preferences; Repeated games; Finitely and infinitely repeated Prisoner's dilemma; Strategies in an infinitely repeated Prisoner's dilemma; Some Nash equilibria of an infinitely repeated Prisoner's dilemma, Nash equilibrium payoffs of an infinitely repeated Prisoner's dilemma</p>	8
5	<b>Unit 5:</b>	8

	<b>Coalitional Games and Bargaining:</b> Coalitional games. The Core. Illustrations: Ownership and distribution of wealth, exchanging homogeneous items, Exchanging heterogeneous items, Voting, Matching. Bargaining as an extensive game; Illustration of trade in a market; Nash's axiomatic model of bargaining	
	<b>Total</b>	45

### Textbooks:

Authors Name	Title	Edition	Publisher, Country	Year
Martin Osborne	An Introduction to Game Theory	2 <sup>nd</sup> Edition	Oxford University Press	2004

### Reference Books:

Authors Name	Title	Edition	Publisher, Country	Year
Roger B. Myerson	Game Theory: Analysis of Conflict	1 <sup>st</sup> Edition	Harvard University Press	1997

### Course Articulation Matrix

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
TCS857.1	Identify strategic situations and represent them as games	-	1	-	3	-	-	-	-	-	-	-	1	2	1	1
TCS857.2	Find dominant strategy equilibrium, pure and mixed strategy Nash equilibrium,	-	1	-	2	-	-	-	-	-	-	1	1	2	1	1
TCS857.3	Solve simple games using various techniques	3	-	-	1	-	-	-	-	-	-	-	2	3	2	1
TCS857.4	Analyze economic situations using game theoretic technique	-	3	-	-	-	-	-	-	-	-	-	1	3	1	1
TCS857.5	Recommend and prescribe which strategies to implement	-	2	-	3	-	-	-	-	-	-	-	2	3	2	1
TCS857.6	Find the needs of extensive games	-	-	-	2	-	-	-	-	-	-	1	1	2	1	1
<b>TCS 857</b>		3	1.75	-	2.2	-	-	-	-	-	-	1	1.33	2.5	1.33	1

High correlation (3); Medium correlation (2); Low correlation (1), No correlation ( - )