TATA CONSULTANCY SERVICES
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B.E. /B.Tech in Computer Science & Business Systems

Semester 4

TCS

Computer Science & Business Systems

Semester 4 Curriculum

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Semester 4

OPERATING SYSTEMS (PCC-CS-403) + Lab (Unix Environment)

Introduction: Concept of Operating Systems (OS), Generations of OS, Typesof OS, OS Services, Interrupt handling andSystem Calls, Basic architectural concepts of an OS, Concept of Virtual Machine, Resource Manager view, process view and hierarchical view of an OS.

Processes: Definition, Process Relationship, Different states of a Process, Process Statetransitions, Process Control Block (PCB), Context switching.

Thread: Definition, Various states, Benefits of threads, Types of threads, Concept ofmultithreads.

Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Schedulingcriteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time.

Scheduling algorithms: Pre-emptive and non-pre-emptive, FCFS, SJF, RR; Multiprocessorscheduling: Real Time scheduling: RM and EDF.

Inter-process Communication: Concurrent processes, precedence graphs,Critical Section, Race Conditions, Mutual Exclusion,Hardware Solution, Semaphores, Strict Alternation, Peterson's Solution, The Producer / Consumer Problem, Event Counters, Monitors, Message Passing,Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem,Barber's shop problem.

Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, DeadlockPrevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

Concurrent Programming: Critical region, conditional critical region, monitors, concurrent languages, communicating sequential process (CSP); Deadlocks - prevention, avoidance, detection and recovery.

Memory Management: Basic concept, Logical and Physical address maps, Memoryallocation: Contiguous Memory allocation – Fixed and variable partition–Internal and External fragmentation and Compaction.

Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Localityof reference, Page allocation, Partitioning, Paging, Page fault, Working Set, Segmentation, Demand paging, PageReplacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Notrecently used (NRU) and Least Recently used (LRU).

I/O Hardware: I/O devices, Device controllers, Direct Memory Access, Principles of I/O.

File Management: Concept of File, Access methods, File types, File operation, Directorystructure, File System structure, Allocation methods (contiguous, linked,

indexed),Free-space management (bit vector, linked list, grouping), directory implementation(linear list, hash table), efficiency and performance.

Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Diskreliability, Disk formatting, Boot-block, Bad blocks.

Case study: UNIX OS file system, shell, filters, shell programming, programming with the standard I/O, UNIX system calls.

Laboratory

1. Unix commands (files directory, data manipulation, network communication etc), shell programming and vi editor
2. C program implementation of the following:
    a. Scheduling Algorithms
    b. Shared memory
    c. Thread and Multi Thread
    d. Inter Process Communication
    e. Deadlock Avoidance and Deadlock Detection
    f. Semaphore
    g. Memory Management
    h. Indexing and Hashing

Text Books:

1. *Operating System Concepts Essentials*. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne.

Reference Books:

1. *Operating Systems: Internals and Design Principles*. William Stallings.
2. *Operating System: A Design-oriented Approach*. Charles Patrick Crowley.
3. *Operating Systems: A Modern Perspective*. Gary J. Nutt.
4. *Design of the Unix Operating Systems*. Maurice J. Bach.
5. *Understanding the Linux Kernel*, Daniel Pierre Bovet, Marco Cesati.

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DATATBASE MANGEMENT SYSTEMS (PCC-CS503) + Lab

Introduction: Introduction to Database. Hierarchical, Network and Relational Models.

Database system architecture: Data Abstraction, Data Independence, Data DefinitionLanguage (DDL), Data Manipulation Language (DML).

Data models: Entity-relationship model, network model, relational and object orienteddata models, integrity constraints, data manipulation operations.

Relational query languages: Relational algebra, Tuple and domain relational calculus,SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL,ORACLE, DB2, SQL server.

Relational database design: Domain and data dependency, Armstrong's axioms, Functional Dependencies, Normal forms, Dependency preservation, Lossless design.

Query processing and optimization: Evaluation of relational algebra expressions, Queryequivalence, Join strategies, Query optimization algorithms.

Storage strategies: Indices, B-trees, Hashing.

Transaction processing: Concurrency control, ACID property, Serializability ofscheduling, Locking and timestamp based schedulers, Multi-version and optimisticConcurrency Control schemes, Database recovery.

Database Security: Authentication, Authorization and access control, DAC, MAC andRBAC models, Intrusion detection, SQL injection.

Advanced topics: Object oriented and object relational databases, Logical databases, Webdatabases, Distributed databases, Data warehousing and data mining.

Laboratory

1. C implementation of a Database Editor.
2. Download standard data of reasonable size (Unit level data of various rounds of NSS surveys) form internet and implement various SQL commands.

Text Books:

1. Database System Concepts. Abraham Silberschatz, Henry F. Korth and S. Sudarshan.

Reference Books:

1. *Principles of Database and Knowledge – Base Systems*, Vol 1 by J. D. Ullman.
2. *Fundamentals of Database Systems*. R. Elmasri and S. Navathe.
3. *Foundations of Databases*. Serge Abiteboul, Richard Hull, Victor Vianu.

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SOFTWARE DESIGN WITH UML + Lab

Introduction to on Object Oriented Technologies and the UML Method.

- Software development process: The Waterfall Model vs. The Spiral Model.
- The Software Crisis, description of the real world using the Objects Model.
- Classes, inheritance and multiple configurations.
- Quality software characteristics.
- Description of the Object Oriented Analysis process vs. the Structure Analysis Model.

Introduction to the UML Language.

- Standards.
- Elements of the language.
- General description of various models.
- The process of Object Oriented software development.
- Description of Design Patterns.
- Technological Description of Distributed Systems.

Requirements Analysis Using Case Modeling

- Analysis of system requirements.
- Actor definitions.
- Writing a case goal.
- Use Case Diagrams.
- Use Case Relationships.

Transfer from Analysis to Design in the Characterization Stage: Interaction Diagrams.

- Description of goal.
- Defining UML Method, Operation, Object Interface, Class.
- Sequence Diagram.
- Finding objects from Flow of Events.
- Describing the process of finding objects using a Sequence Diagram.
- Describing the process of finding objects using a Collaboration Diagram.

The Logical View Design Stage: The Static Structure Diagrams.

- The Class Diagram Model.
- Attributes descriptions.
- Operations descriptions.
- Connections descriptions in the Static Model.

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- Association, Generalization, Aggregation, Dependency, Interfacing, Multiplicity.

Package Diagram Model.

- Description of the model.
- White box, black box.
- Connections between packagers.
- Interfaces.
- Create Package Diagram.
- Drill Down.

Dynamic Model: State Diagram / Activity Diagram.

- Description of the State Diagram.
- Events Handling.
- Description of the Activity Diagram.
- Exercise in State Machines.

Component Diagram Model.

- Physical Aspect.
- Logical Aspect.
- Connections and Dependencies.
- User face.
- Initial DB design in a UML environment.

Deployment Model.

- Processors.
- Connections.
- Components.
- Tasks.
- Threads.
- Signals and Events.

Laboratory

UML include the following 9 diagrams:

1. Class Diagram
2. Object Diagram
3. Use Case Diagram

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4. Sequence Diagram
5. Collaboration Diagram
6. State Chart Diagram
7. Activity Diagram
8. Component Diagram
9. Deployment Diagram

For the following Applications:

- ATM Systems
- Stock Maintenance System
- Remote Procedure Call Implementation

draw the UMLS diagrams.

Text Books:

1. *The Unified Modelling Language User Guide.* Grady Booch, James Rumbaugh, Ivar Jacobson, Pearson Education.

2. *Object-Oriented Software Engineering: using UML, Patterns, and Java.* Bernd Bruegge and Allen H. Dutoit.

Reference Books:

1. *Design Patterns: Elements of Reusable Object-Oriented Software*. Erich Gamma, Richard Helm, Ralph Johnson, and John M. Vlissides.

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Business Communication & Value Science 3

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: 2.5 Hrs./Week	Semester Examination: 50 marks	4
Practical: 1.5 Hrs. / Week	Continuous Assessment: Yes	
Lab: 2 Hrs. / Week	Term Work: 50 marks	

Course ID:

	Leadership Oriented Learning (LOL)	

Nature of Course	Behavioral
Pre requisites	Basic Knowledge of English (verbal and written) Completion of all units from Semesters 1, 2 and 3

Course Objectives:

1	Develop technical writing skills
2	Introduce students to Self-analysis techniques like SWOT & TOWS
3	Introduce students to key concepts of: a) Pluralism & cultural spaces b) Cross-cultural communication c) Science of Nation building

Course Outcomes:

Upon completion of the course, students shall have ability to

C2.6.1	Apply & analyze the basic principles of SWOT & life positions.	[U]

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C2.6.2	Understand, analyze & leverage the power of motivation in real life	[AP]
C2.6.3	Identify & respect pluralism in cultural spaces	[AP]
C2.6.4	Understand and apply the concepts of Global, glocal and translocational	[C]
C2.6.5	Analyze cross cultural communication	[U]
C2.6.6	Apply the science of Nation building	[AP]
C2.6.7	Identify the common mistakes made in cross-cultural communication	[E]
C2.6.8	Understand, apply & analyze the tools of technical writing	[U]
C2.6.9	Recognize the roles and relations of different genders.	[AP]
C2.6.10	Understand Artificial intelligence &recognize its impact in daily life	[U]
C2.6.11	Identify the best practices of technical writing	[AP]
C2.6.12	Differentiate between the diverse culture of India	[E]

Course Contents:

Objectives for Semester 4

After completing this semester, learners will be able to:

- Summarize the basic principles of SWOT and Life Positions.
- Apply SWOT in real life scenarios.
- Recognize how motivation helps real life.
- Leverage motivation in real-life scenarios.
- Identify pluralism in cultural spaces.
- Respect pluralism in cultural spaces.
- Differentiate between the different cultures of India.
- Define the terms global, glocal and translocational.
- Differentiate between global, glocal and translocational culture.
- Recognize the implications of cross-cultural communication.
- Identify the common mistakes made in cross-cultural communication.
- Apply cross-cultural communication.
- Differentiate between the roles and relations of different genders.
- Summarize the role of science in nation building.
- Define AI (artificial intelligence).
- Recognize the importance of AI.

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• Identify the best practices of technical writing. • Apply technical writing in real-life scenarios.	
Total Hours:	48 hours
Text Books:	
	There are no prescribed texts for Semester 4 – there will be handouts and reference links shared.
Reference Books:	
1	
2	
3	
4	
Web References:	
1	Examples of Technical Writing for Students https://freelance-writing.lovetoknow.com/kinds-technical-writing
2	11 Skills of a Good Technical Writer https://clickhelp.com/clickhelp-technical-writing-blog/11-skills-of-a-good-technical-writer/
3	13 benefits and challenges of cultural diversity in the workplace https://www.hult.edu/blog/benefits-challenges-cultural-diversity-workplace/
Online Resources:	
1	https://youtu.be/CsaTslhSDI

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2	https://m.youtube.com/watch?feature=youtu.be&v=IIKvV8_T95M
3	https://m.youtube.com/watch?feature=youtu.be&v=e80BbX05D7Y
4	https://m.youtube.com/watch?v=dT_D68RJ5T8&feature=youtu.be
5	https://m.youtube.com/watch?v=7sLLEdBgYYY&feature=youtu.be

Assessment Methods & Levels (based on Bloom's Taxonomy)

Formative assessment (Max. Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
C1.6.1	Analyze	SWOT in real life	5
C1.6.2	Analyze	Motivation in real life	4

Summative Assessment based on End Semester Project

Bloom's Level		
Understand	Written Assessment, project and group discussion	50
Apply		
Analyze		

Lesson Plan

Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
			Guest lecture by a renowned personality to kick start this semester.	This will be outside the total hours for this Semester	**90 mins**
1			REUNION	Activity	

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Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
			Recap activity on the earlier learning after a 6 months break. If we can flash the projects they completed in the last semester…… End with a Quiz in multiple format rounds testing the objectives.		60 Minutes
1	**Summarize the basic principles of SWOT and Life Positions.**	2	SWOT and Life Positions Meet Dananjaya: Meet Dananjaya Hettiarachchi The World Champion of Public Speaking 2014 who made the winning speech which was rated amongst the "Most talked-about speeches of 2014". https://www.youtube.com/watch?v=bbz2boNSeL0&t=24s Debrief on the video. How it relates to SWOT. **Intro activity**: Give story of an individual* and divide people into 4 groups S W O T and ask them to jot down the SWOT. Start with a different nomenclature (demystifying SWOT)	Lecture and activity	60 Minutes

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Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
1	Apply SWOT in real life scenarios.	3	Pat your back activity…strength will be written by others other points by you Create your SWOT	Practical	60 Minutes
1	Apply SWOT in real life scenarios.	3	SWOT Vs. TOWS The Balancing Act Ted talk on biomimicry: (Only first 8 mins): https://www.youtube.com/watch?v=RHrO4t86phA Debrief on the Ted talk in which the facilitator gently guides the group towards the understanding that survival happens only when we seek ideas from the external world to turn the threat into opportunity Research on TOWS and find out how you can turn your threat into opportunity. Two people mutually identifying opportunities from each other's threats.	Lab	120 minutes
1	Apply SWOT in real life scenarios.	3	Presentation on what are the strengths they have identified to survive in the VUCA World. Group presentations of 10	Formative evaluation	90 mins

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Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
			mins each.		
1	Recognize how motivation helps real life.	1	Motivation Stories YouTube videos on Maslow's Theory	Lecture and activity	90 mins
1	Leverage motivation in real-life scenarios.	3	Scenario based activity on identifying and leveraging motivation	Formative evaluation/Lab	60 mins
1	Recognize how motivation helps real life.	1	Present their findings and approaches as groups. They need to explain the idea of motivation with the help of examples.	Practical	60 mins
Unit 2					
2	Identify pluralism in cultural spaces.	1	Rivers of India a. Divide participants into groups of 5. Each group should assign themselves a name from the Indian Rivers. These groups will continue throughout this Unit. b. Learn and Exchange Group activity in which participants need to learn the following four greetings of a state (different from their own) and exchange it with another group: • Good morning	Activity	90 Minutes

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Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
			• Thank you • Sorry • Good night Indicative only		
2	Identify pluralism in cultural spaces. Respect pluralism in cultural spaces.	2 3	a. Awareness and respect for pluralism in cultural spaces b. Announce the Rhythms of India activity to be held in the next session. The rules of the activity will be detailed at this point. Teams to prepare for the performance beyond class hours.	Theory/Discussion using Phir Miley Sur Mera Tumhara	90 Minutes
2	Differentiate between the different cultures of India.	2	Rhythms of India (Cultures in India) Group activity: Each group to perform a short dance piece (3 mins) from any of the Indian states (to be decided by lots). They have to present the background and unique features of the dance form (5 min).	Practical/Discussion	120 Minutes
2	• Define the terms global, glocal and translocational. • Differentiate between global, glocal and translocational culture.	1, 2	a. Global, glocal, translocational Use Ted and YouTube videos to show examples b. Announce debate to be held in the next session. They have to come prepared for the debate/discussion.	Lecture/Discussion	60 mins

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Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
2	Differentiate between global, glocal and translocational culture.	2	Debate on Global, glocal, tanslocational impacts (topics to be decided by the faculty or suggested by the students). Debate to be held in the presence of an external moderator. Eight groups will get four topics to debate upon.	Activity	60 mins
2	• Recognize the implications of cross-cultural communication. • Identify the common mistakes made in cross-cultural communication.	1, 2	Cross-cultural communication A. Verbal and non-verbal communication (approach is through videos). Point out the obvious mistakes. From our perspective…how anyone would feel if someone else made mistakes about our cultures. B. Let participants have a group discussion on the implications of cross cultural communication.	Lecture/Discussion	60 mins
2	Apply cross cultural communication.	3	Suggested long-term activity: A VR game in which learners can visit different locations of the world and overcome challenges by using cross cultural skills.		
2	Identify the common mistakes made in cross-cultural communication	2	Culture shock Group activity to perform skits based on situations provided by the lecturer.	Practical	60 mins

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Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
2	Differentiate between the roles and relations of different genders.	2	Gender awareness Participants will view relevant scenarios in the class and then participate in a reflection activity in group. The scenarios can be presented using an Augmented Reality intervention.	Discussion	90 mins
2	Differentiate between the roles and relations of different genders.	2	Gender awareness campaign Groups to present the detailed plan of Gender awareness campaigns with four different themes. • College • Workplace • Family • Friends	Activity	60 mins
2			Quiz Time	Summative Evaluation for Unit	60 Minutes
Unit 3					
3	Summarize the role of science in nation building.	2	Role of science in nation building Introduce the topic and discuss the role of scientists and mathematicians from ancient India. Break the students into groups and give them ten minutes to access internet and get information about ten	Theory and lab	90 mins

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Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
			eminent scientists and mathematicians of ancient India. Groups will be given five minutes to present on the next day. Groups will also frame two questions which they will ask after presenting. This can also be taught through Augmented Reality, where images of the scientists will be put up around the class and they will be able to gather the information by using their phones and AR app.		
			Groups present their findings. Other groups note down their learning. At the end there will be a quiz to assess their learning.	Activity	90 mins
	Summarize the role of science in nation building.	2	Role of science post-independence Groups to present using multiple formats on any one of the four given topics. • Inventions • Inventors • Institutes • Information technology	Lab and practical	120 mins

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Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
	Identify the best practices of technical writing.	1	Introduction to technical writing Basic rules of technical writing through examples.	Lecture (Guest faculty, over webinar)	60 mins
	Identify the best practices of technical writing.	1	Practice activity on technical writing.	Lab	60 mins
	Apply technical writing in real-life scenarios.	3	Assessment on technical writing on the following topic: Explain the following to a visually impaired person: • DNA • Rings of Saturn • Structure of an oxygen atom • Structure of heart	Summative evaluation	60 mins
Unit 4					
4	Define AI (artificial intelligence).	1	"Voice of the Future" Activity How will a voice assistant evolve in 25 years from now? Each group will present a skit.	Activity	90 mins
	Recognize the importance of AI.	1	AI in Everyday Life Discussion in groups on given topics and then cross sharing of discussion points amongst the groups.	Lab and Activity	90 mins

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Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
	Recognize the importance of AI.	1	Design your college in the year 2090 Groups need to create the college of future with the future teachers, teaching methods, types of students, etc. We will end the session with the question: How will offices/workplaces change in future? Who do you think would be your colleagues?	Lab and Practical	90 mins
	Recognize the importance of AI.	1	Communicating with machines Theory and Ted talk videos	Lecture	60 mins
	Recognize the importance of AI.	1	Debate in the presence of an external moderator. Will machines control us in future?	Discussion	90 mins
	Identify the best practices of technical writing.	1	Applying technical writing in profession Theory with YouTube and Dr Bimal Ray's videos. Dr Bimal Kumar Roy, a former Director of the Indian Statistical Institute, is a cryptologist from the Cryptology Research Group of the Applied Statistics Unit of ISI, Kolkata.	Lecture	90 mins

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Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
	Apply technical writing in real-life scenarios.	3	Scenario-based Assessment on technical writing Each group will make a presentation on the following: a) Sell Analytics and Insight to the local tea seller. b) Explain the concept of Cloud to your 87 year old grandmother. c) Introduce the concept of friendly robots to a class 3 kid. Explain IOT to your helping hand at home	Summative evaluation	60 mins
Project					
			Visit rural area/ underprivileged parts of city to address some of the local issues; if relevant, suggest a practical technology solution to the issues.	Project	10 hours

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Operations Research + Lab

Introduction to OR:
Origin of OR and its definition. Concept of optimizing performance measure, Types of OR problems,Deterministic vs. Stochastic optimization, Phases of OR problem approach – problem formulation,building mathematical model, deriving solutions, validating model, controlling and implementingsolution.

Linear Programming:
Linear programming – Examples from industrial cases, formulation & definitions, Matrix form. Implicit assumptions of LPP.
Some basic concepts and results of linear algebra – Vectors, Matrices, LinearIndependence/Dependence of vectors, Rank, Basis, System of linear eqns., Hyperplane, Convex set,Convex polyhedron, Extreme points, Basic feasible solutions.
Geometric method: 2-variable case, Special cases – infeasibility, unboundedness, redundancy &degeneracy, Sensitivity analysis.
Simplex Algorithm – slack, surplus & artificial variables, computational details, big-M method,identification and resolution of special cases through simplex iterations.
Duality – formulation, results, fundamental theorem of duality, dual-simplex and primal-dualalgorithms.

Transportation and Assignment problems:
TP - Examples, Definitions – decision variables, supply & demand constraints, formulation, Balanced & unbalanced situations, Solution methods – NWCR, minimum cost and VAM, test for optimality(MODI method), degeneracy and its resolution.
AP - Examples, Definitions – decision variables, constraints, formulation, Balanced &unbalanced situations, Solution method – Hungarian, test for optimality (MODI method), degeneracy & its resolution.

PERT – CPM:
Project definition, Project scheduling techniques – Gantt chart, PERT & CPM, Determination ofcritical paths, Estimation of Project time and its variance in PERT using statistical principles, Conceptof project crashing/time-cost trade-off.

Inventory Control:
Functions of inventory and its disadvantages, ABC analysis, Concept of inventory costs, Basics ofinventory policy (order, lead time, types), Fixed order-quantity models – EOQ, POQ & Quantitydiscount models. EOQ models for discrete units, sensitivity analysis and Robustness, Special cases ofEOQ models for safety stock with known/unknown stock out situations, models under prescribedpolicy, Probabilistic situations.

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Operations Research + Lab(continued)

Queuing Theory:
Definitions – queue (waiting line), waiting costs, characteristics (arrival, queue, service discipline) ofqueuing system, queue types (channel vs. phase).
Kendall's notation, Little's law, steady state behaviour, Poisson's Process & queue, Models with examples - M/M/1 and its performance measures; M/M/m and its performance measures; brief description aboutsome special models.

Simulation Methodology:
Definition and steps of simulation, random number, random number generator, Discrete EventSystem Simulation – clock, event list, Application in Scheduling, Queuing systems and Inventory systems.

Laboratory

1. Formulation of linear programming problems.
2. Solution of linear programming problem using graphical method with:
    i. Multiple constraints
    ii. Unbounded solution
    iii. Infeasible solution
    iv. Alternative or multiple solution
3. Enumeration of all basic solutions for linear programming problem.
4. Solution of linear programming problem with simplex method.
5. Problem solving using Big M method.
6. Problem solving using two phase method.
7. Solution on primal problem as well as dual problem.
8. Solution based on dual simplex method.
9. Verification of weak duality, strong duality and complementary slackness property.
10. Solution of transportation problem.
11. Solution of assignment problem.
12. Solution of integer programming problem using Branch and Bound method.
13. Solution of integer programming problem using Gomory's cutting plane method.
14. Simulation: Random number generation.
15. Monte Carlo method.
16. Performance measures for M/M/1 queuing model.
17. ABC analysis.
18. Inventory model.

Text Books:

1. *Operations Research: An Introduction.*H.A. Taha.

Reference Books:

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1. *Linear Programming*. K.G. Murthy.
2. *Linear Programming.* G. Hadley.
3. *Principles of OR with Application to Managerial Decisions*. H.M. Wagner.
4. *Introduction to Operations Research*. F.S. Hiller and G.J. Lieberman.
5. *Elements of Queuing Theory*. Thomas L. Saaty.
6. *Operations Research and Management Science, Hand Book*: Edited By A. Ravi Ravindran.
7. *Management Guide to PERT/CPM*. Wiest & Levy.

Modern Inventory Management. J.W. Prichard and R.H. Eagle.

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Introduction to Innovation, IP Management & Entrepreneurship

Course Outcome(s):

The major emphasis of the course will be on creating a learning system through which management students can enhance their innovation and creative thinking skills, acquaint themselves with the special challenges of starting new ventures and use IPR as an effective tool to protect their innovations and intangible assets from exploitation.

As a part of this course, students will:

- Learn to be familiar with creative and innovative thinking styles
- Learn to investigate, understand and internalize the process of founding a startup
- Learn to manage various types of IPR to protect competitive advantage

Topics to Be Covered:

UNIT – I

Innovation: What and Why?

Innovation as a core business process, Sources of innovation, Knowledge push vs. need pull innovations.

Class Discussion- Is innovation manageable or just a random gambling activity?

UNIT – II

Building an Innovative Organization

Creating new products and services, Exploiting open innovation and collaboration, Use of innovation for starting a new venture

Class Discussion- Innovation: Co-operating across networks vs. ‘go-it-alone’ approach

UNIT – III

Entrepreneurship:

- Opportunity recognition and entry strategies
- Entrepreneurship as a Style of Management

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- Maintaining Competitive Advantage- Use of IPR to protect Innovation

UNIT – IV

Entrepreneurship- Financial Planning:

- Financial Projections and Valuation
- Stages of financing
- Debt, Venture Capital and other forms of Financing

UNIT – V

Intellectual Property Rights (IPR)

- Introduction and the economics behind development of IPR: Business Perspective
- IPR in India – Genesis and Development
- International Context
- Concept of IP Management, Use in marketing

UNIT – VI

Types of Intellectual Property

- Patent- Procedure, Licensing and Assignment, Infringement and Penalty
- Trademark- Use in marketing, example of trademarks- Domain name
- Geographical Indications- What is GI, Why protect them?
- Copyright- What is copyright
- Industrial Designs- What is design? How to protect?

Class Discussion- Major Court battles regarding violation of patents between corporate companies

Home Assignment:

Case study materials book will be given to students. Students are required to meet in groups before coming to class and prepare on the case for the day. Instructor may ask the student groups to present their analysis and findings to the class.

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Further, the topic for class discussion will be mentioned beforehand and students should be ready to discuss these topics (in groups) in class. Students are required to meet in groups before coming to class and prepare on the topic. Few topics are mentioned below as examples. Instructor can add or change any topic as per requirement.

Topic 1- Is innovation manageable or just a random gambling activity?

Topic 2- Innovation: Co-operating across networks vs. 'go-it-alone' approach

Topic 3- Major Court battles regarding violation of patents between corporate companies

Text Books:

1. Joe Tidd, John Bessant. Managing Innovation: Integrating Technological, Market and Organizational Change
2. Case Study Materials: To be distributed for class discussion

B.E. /B.Tech in Computer Science & Business Systems

Semester 4

Essence of Indian Traditional Knowledge (Non Credit)

(To be finalised by Respective Institute)