1. THE SCHEME

Course Title	Research Methodology and IPR			Course Type		Theory	
Course Code	R1UC701T			Class		B-Tech Core and All specialization (IV-YR)	

Instruction delivery	Activity	Credits	Credit Hours	Total Number of Classes per Semester				Assessment in Weightage	
				Theory	Tutorial	Practical	Self-study	CIE	SEE
	Lecture	3	3						
	Tutorial	0	0						
	Practical	0	0						
	Self-study	0	0						
	Total	3	3	40	0	0	0	50%	50%

Course Lead	Dr. Prashant Dixit	Course Coordinator	Mr. Sachin Jain

Names Course Instructors	Theory	Practical
	1. Abdul Aleem 2. Amit Kumar 3. Arvind Dagur 4. Manish Verma 5. Mukesh Kumar 6. Murari Krishna Saha 7. Nripendra Dwivedi 8. P Sudhakar 9. Pragya 10. Prashant Dixit 11. Ruby Dahiya 12. S. Srinivasan 13. Sachin Jain 14. Santosh Kumar 15. Sonia Kukreja 16. Suman Mann 17. Suveg Moudgil 18. Swati Sharma 19. Vimal Singh	

2. COURSE OVERVIEW

This course deals with the research methods and Intellectual property rights (IPR) that refer to the legal rights given to the inventor or creator to protect his invention or creation for a certain period of time. These legal rights confer and exclusive right to the inventor/creator or his assignee to fully utilize his invention/creation for a given period of time. In this course, the students will be able to learn to write research paper following all the ethics, to do research using different methods. Upon completion of this course, the students will be able to write the research paper using proper format and students will contribute their knowledge in the field of research to serve the society with innovative and creative ideas.

3. COURSE OBJECTIVES

- Identify and formulate research problem in their interesting domain.
- To explain the functions of the literature review in research and research ethics.
- To demonstrate carrying out a literature search, its review, developing theoretical and conceptual frameworks and writing a review.
- To explain how IPR would take such important place in growth of individuals & nation, to summaries the need of information about Intellectual Property Right to be promoted among student community in general & engineering in particular.
- To Relate that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about economic growth and social benefits
- To apply the basic concept of deep learning in their implementation over various datasets.
- To implement various automatic model of Deep Learning neural networks and evaluate their performance.

4. PREREQUISITE COURSE

PREREQUISITE COURSE REQUIRED	No	
If, yes please fill in the Details	Course code	Course Title

5. PROGRAM OUTCOMES (POs):

PO No.	Description of the Program Outcome
PO1	**Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex Computer Science and engineering problems.
PO2	**Problem Analysis**: Identify, formulate, review research literature, and analyze complex Computer Science and engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/Development of Solutions:** Design solutions for complex Computer Science and engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex computer science and engineering activities with an understanding of the limitations.
PO6	**The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex Computer Science and engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-Long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological changes in the field of Computer Science.

6. PROGRAM SPECIFIC OUTCOMES (PSOs):

Program Specific Outcomes (PSO) are statements that describe what the graduates of a discipline-specific program should be able to do. Two to Three PSOs per program should be designed.

PO No.	Description of the Program-Specific Outcome
PSO1	Have the ability to work with emerging technologies in computing requisite to Industry 4.0.
PSO2	Demonstrate Engineering Practice learned through industry internship and research project to solve live problems in various domains.

7. COURSE CONTENT (THEORY)

CONTENT (Syllabus)
THEORY: **MEANING OF RESEARCH PROBLEM:** Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations. **LITERATURE STUDIES:** Effective literature studies approach, analysis Plagiarism, and Research ethics. **TECHNICAL WRITING:** Effective technical writing, how to write report, Paper Developing a Research Proposal. Format of research proposal, a presentation and assessment by a review committee. **PATENT PROPOSAL:** Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT. **PATENT RIGHTS AND NEW DEVELOPMENTS IN IPR:** Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

8. COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO No.	Description of the Course Outcome
R1UC701T.1	Define the scope and objectives of a research problem and list out criteria and characteristics of a good research problem
R1UC701T.2	Apply the literature study approaches and adapt research ethics in professional life.
R1UC701T.3	Prepare a well-structured research paper and scientific presentations
R1UC701T.4	Illustrate various IPR components and process of filing.
R1UC701T.5	Summaries the present-day scenario controlled and monitored by Computer and Information Technology, where the future world will be ruled by dynamic ideas, concept, creativity and innovation.

9. TAXONOMY LEVEL OF THE COURSE OUTCOMES

Mapping of COs with Bloom's Level

CO No.	Remember KL1	Understand KL 2	Apply KL 3	Analyse KL 4	sYNTHESIZE KL 2	Evalte KL 6
R1UC701T.1	√		√			
R1UC701T.2			√			
R1UC701T.3				√	√	
R1UC701T.4			√	√		
R1UC701T.5		√			√	√

10. COURSE ARTICULATION MATRIX

COs#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
R1UC701T.1	-	2	-	-	-	-	-	-	-	-	-	-	-	-
R1UC701T.2	1	3	1	-	-	-	-	3	-	-	-	-	2	2
R1UC701T.3	2	-	-	-	3	1	-	-	2	1	-	1	2	2
R1UC701T.4	-	2	2	-	1	-	-	-	1	1	2	-	1	-

R1UC701T.5	-	-	-	-	-	3	3	-	3	-	-	1	1	1

Note: 1-Low, 2-Medium, 3-High \ *first semester first course and first Course Outcome

11. TYPICAL EXAMPLE OF COURSES, CREDIT HOURS AND TEACHING HOURS

Type of Course	Credits Hours					Hours of engagement/ Week					12 weeks/ semester	Remarks
	Theory	Tutorial	Practical	Self-study	Total	Theory	Tutorial	Practical	Self-study	Total	Total no. of classes	
Theory Course	3	0	0	0	3	3	0	0	0	3	40	40 classes for theory

*1 credit = 3 self-learning hours (Not to mention in the lesson plan)

L-No	Topic for Delivery	Tutorial / Practical Plan	Skill	Competency
1	Meaning of research problem	Theory	Understand the basic concept of research problem and research process.	CO1
2	Sources of research problem	Theory		
3	Criteria Characteristics of a good research problem	Theory		
4	Errors in selecting a research problem	Theory		
5	Scope and objectives of research problem	Theory		
6	Approaches of investigation of solutions for research problem	Theory		
7	Data analysis, interpretation, Necessary instrumentations	Theory		
8	Effective literature studies approaches	Theory	Understand research ethics and how to write a literature review	CO2
9	Effective literature studies approaches	Theory		
10	Effective literature studies approaches	Theory		
11	Analysis Plagiarism	Theory		
12	Research ethics	Theory		
13	Effective technical writing	Theory		
14	Effective technical writing	Theory		
15	How to write report	Theory	Understand and prepare a well structured research paper and scientific presentations	CO3
16	Paper Developing a Research Proposal	Theory		
17	Format of research proposal	Theory		
18	a presentation and assessment by a review committee	Theory		
19	Nature of Intellectual	Theory		

20	Property	Theory		
21	Patents, Designs	Theory		
22	Trade and Copyright	Theory	Understand the adequate knowledge on patent and rights	CO4
23	Process of Patenting and Development	Theory		
24	technological research, innovation, patenting	Theory		
25	International Scenario: International cooperation on Intellectual Property	Theory		
26	Procedure for grants of patents	Theory		
27	Patenting under PCT	Theory		
28	Patent Rights: Scope of Patent Rights	Theory		
29	Licensing and transfer of technology	Theory		
30	Licensing and transfer of technology	Theory	Analysis and explore on various IPR components and process of filing.	CO5
31	Patent information and databases	Theory		
32	Geographical Indications	Theory		
33	New Developments in IPR	Theory		
34	Administration of Patent System	Theory		
35	New developments in IPR; IPR of Biological Systems	Theory		
36	IPR of Biological Systems, Computer Software etc	Theory		
37	Traditional knowledge Case Studies, IPR and IITs	Theory		
38	Traditional knowledge Case Studies, IPR and IITs	Theory		
39	Traditional knowledge Case Studies, IPR and IITs	Theory		
40	Traditional knowledge Case Studies, IPR and IITs	Theory		

12. BIBLIOGRAPHY

- **TextBook:**
  1. Research Methodology. Methods & Technique: Kothari. C.R.
  2. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students"
  3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step-by-Step Guide for beginners
- ReferenceBooks:
  1. Cooper Donald R, Schindler Pamela S and Sharma JK, "Business Research Methods", Tata McGraw Hill Education, 11e (2012).
  2. Catherine J. Holland, "Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets", Entrepreneur Press, 2007.
  3. David Hunt, Long Nguyen, Matthew Rodgers, "Patent searching: tools & techniques", Wiley, 2007.
  4. The Institute of Company Secretaries of India, Statutory body under an Act of parliament, "Professional Programme Intellectual Property Rights, Law and practice", September 2013
- Webliography:
  1. https://www.tutorialspoint.com/fundamentals-of-research-methodology/index.asp
  2. https://www.slideshare.net/DrKapilGupta2/research-methodology-ipri
  3. https://www.geeksforgeeks.org/intellectual-property-rights/
  4. **https://www.youtube.com/watch?v=6FPkTnMTZpc**
  5. **https://www.youtube.com/watch?v=GSeeyJVD0JU**
  6. **https://www.youtube.com/watch?v=ZLjmuKwUfWk**
- SWAYAM/NPTEL/MOOCsCertification:
  1. Course Name: Research Methodology, By Prof. Soumitro Banerjee, IISER,Kolkata.
     https://onlinecourses.nptel.ac.in/noc22_ge08/preview

2. Course Name: Introduction To Research, By Prof.Prathap Haridoss, IIT MADRAS.
   https://archive.nptel.ac.in/courses/121/106/121106007/
3. Course Name: Research Methodology, By Prof. G. S. Bajpai, NLU, Delhi.
   https://onlinecourses.swayam2.ac.in/cec20_hs17/preview

13. COURSE ASSESSMENT

Assessment forms an integral part of curriculum design. A learning-teaching system can only be effective if the student's learning is measured at various stages which means while the student processes learning (Assessment for Learning) a given content and after completely learning a defined content (Assessment of Learning). Assessment for learning is referred to as formative assessment, that is, an assessment designed to inform instruction.

The ability to use and apply the knowledge in different ways may not be the focus of the assessment. With regard to designing assessments, the faculty members must be willing to put in the time required to create a valid, reliable assessment, that ideally would allow students to demonstrate their understanding of the information while remaining. The following are the five main areas that assessment reporting should cover.

1. **Learning Outcomes**: At the completion of a program, students are expected to know their knowledge, skills, and attitude. Depending on whether it is a UG or PG program, the level of sophistication may be different. There should be no strict rule on the number of outcomes to be achieved, but the list should be reasonable, and well-organized.

2. **Assessable Outcomes**: After a given learning activity, the statements should specify what students can do to demonstrate. Criteria for demonstration are usually addressed in rubrics and there should be specific examples of work that doesn't meet expectations, meets expectations, and exceeds expectations. One of the main challenges is faculty communication whether all faculty agreed on explicit criteria for assessing each outcome. This can be a difficult accomplishment when multiple sections of a course are taught or different faculty members. Hence there is a need for common understanding among the faculty on what is assessed and how it is assessed.

3. **Assessment Alignment**: This design of an assessment is sometimes in the form of a curriculum map, which can be created in something as easy as an Excel spreadsheet. Courses should be examined to see which program outcomes they support, and if the outcome is assessed within the course. After completion, program outcomes should be mapped to multiple courses within the program.

4. **Assessment Planning**: Faculty members need to have a specific plan in place for assessing each outcome. Outcomes don't need to be assessed every year, but faculty should plan to review the assessment data over a reasonable period of time and develop a course of action if the outcome is not being met.

5. **Student Experience**: Students in a program should be fully aware of the expectations of the program. The program outcomes are aligned on the syllabus so that students are aware of what course outcomes they are required to meet, and how the program outcomes are supported. Assessment documents should clearly communicate what is being done with the data results and how it is contributing to the improvement of the program and curriculum.

Designing quality assessment tools or tasks involves multiple considerations if it is to be fit for purpose. The set of assessments in a course should be planned to provide students with the opportunity to learn as they engage with formative tasks as well as the opportunity to demonstrate their learning through summative tasks. Encouraging the student through the use of realistic, authentic experiences is an exciting challenge for the course faculty team, who are responsible for the review and quality enhancements to assessment practices.

14. FORMATIVE AND SUMMATIVE ASSESSMENT

Assessment Pattern for Theory Course:

Type of Course (T)	CIE			Total Marks		Final Marks CIE*0.5+SEE*0.5
	IA1#	MTE	IA2#	CIE	SEE	
THEORY	25	50	25	100	100	100

#Typical Rubric for the Internal Assessments

Type of Assessment Tools	QUIZ	AAT$/MOOC Certifications
Internal Assessments	10	15
$AAT is Literature survey, Seminar, Assignment, Term Paper, Slip Test (or) MOOC Certificate relevant to the course		

15. PASSING STANDARDS

Passing Criteria for Different Course Types Effective from AY 2022-23 Onwards

S.No.	Course Type	Passing Criterion
1.	**Theory Course (T)**	A student shall secure a minimum of **30% of the maximum marks** in the semester-end examination (SEE/ETE) and **40% of aggregate marks** in the course including Continuous internal examination (CIE) and SEE/ETE marks. i.e., the minimum Passing Grade is "P".

Note: Students unable to meet the overall passing criteria as mentioned shall be eligible for the following options to clear the course:

- Appear in the Back Paper Examinations and have to meet the criteria to score 40% in marks overall
- Appear in summer examinations (Internal +External) to meet the criteria as mentioned.

16. PROBLEM-BASED LEARNING/CASE STUDIES/CLINICS

Exercises in Problem-based Learning (Assignments) (Min 54 Problems)

S.No.	Problem	KL
1	Define the term" Research" and also explains the difference between Methos and Methodology in research.	K1
2	Explain the different steps involved in process of Research with its neat and clean diagram.	K2
3	List the number of stages in the research process.	K1
4	List any five techniques used in sample design.	K1
5	List the difference between Deliberate sampling and Simple random sampling.	K1
6	Explain the types of research problems. Also explain the two main steps involved in formulation of research problem.	K2
7	Explain the Meaning of Research design with its different components.	K2
8	Explain the characteristics necessary for good research.	K2
9	Consider the following method used to teach the mathematics: "Students will get example of angles, after that they will learn the definition and find the examples of angles. "Identify the type of logical reasoning should be used by the above method.	K3
10	Consider the following Method used by the Teacher to teach mathematics to students: "The Teacher introduced the theory and explains the rules of the theory and the formula, and the students are asked to solve the problems using the given formula." Identify the type of logical reasoning should be used by the above method.	K3

.11	List the different sources of the research problem.	K1
12	Define the Research Problem with its component.	K1
13	Explain different types of data in brief.	K2
14	Explain the different data collection strategies.	K2
15	Explain the role of literature review in formulation of research problem.	K2
16	Discuss the consequences selecting vague research problem.	K2
17	Identify and explain the approaches of investigation of solution of the research problem.	K3
18	Write the significance of research problem in research process.	K3
19	Write and explain the possible problems encountered by the researcher in India.	K3
20	Discuss the different steps involved in report writing.	K3
21	Discuss the type of research briefly.	K3
22	Determine the steps necessary to write a good report.	K3
23	Explain the types of Patents.	K3
24	Explain the motivation for research.	K3
25	Examine the steps a researcher should use to prevent the abduction of his research work.	K4
26	Explain the meaning of Intellectual Property rights	K3
27	Evaluate the different criteria for a Patent grant.	K5
28	Propose the different steps a researcher should take while selecting a research problem	K6
29	Describe the secondary data collection strategy.	K6
30	Argue the necessity of formulation of hypothesis in research.	K6

17. STUDENT-CENTERED LEARNING (SELF-LEARNING TOWARDS LIFE-LONG LEARNING)

S.No.	Typical Project/Problem	KL
1	Students will review the Research Papers and will write a Survey Paper for IAs.	KL6