

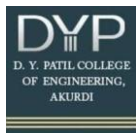
D Y Patil College of Engineering, Akurdi, Pune
 An Autonomous Institute from AY 2024-25, Affiliated to Savitribai Phule Pune University, Pune
Department of Electronics and Telecommunication

SY M Tech VLSI and Embedded Systems, Semester III

Syllabus Structure

Course Code	Course	Teaching Scheme				Evaluation Scheme				
		L	T	P	Cr	Exam	Theory % Marks		Practical % Marks	
							Max	Min for Pass	Max	Min for Pass
VES2411P01	Dissertation Phase I	0	0	8	4	CCA	-	-	100	40
VES2411P02	Dissertation Phase II	0	0	8	4	CCA	-	-	50	40
						ESE	-	-	50	
XXX2411L01	Open Elective	4	0	0	4	CCA	50	20	40	-
						ESE	50	20		-
VES2411P03	On Job Training/Internship	0	0	20	10	CCA	-	-	100	40
Total		4	0	36	22					

Course Code	Open Elective
MDE2411L01	3 D Printing
CME2411L01	Soft Computing
CTM2411L01	Project Management & Finance
ENE2411L01	Environment and Sustainability
RNA2411L01	Robotics & Automation
VES2411L01	Optimization Techniques



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Category: Dissertation Phase

Course Code: VES2411P01

Course Title: Dissertation Phase I

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory % Marks		Practical % Marks		
					Max	Min for Pass	Max	Min for Pass	
0	0	8	4	CCA	-	-	-	-	
0	0	104	Total: 104	ESE	-	-	100	40	

Prerequisites: Completion of all 4 semesters

Course Objectives:

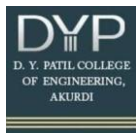
To prepare the synopsis of the dissertation

Course Outcome: After successful completion of the course the student will be able to

CO1	Construct the Synopsis on the Dissertation topic considering Statement of Problem, Significance, Objective, Hypothesis and Methodology.
CO2	Demonstrate the Synopsis on the Dissertation topic with Classified Literature Review, Rationale, Research Question, Time Frame, Budget and References.

Syllabus

Unit I	Synopsis Submission	70 hrs
<ol style="list-style-type: none">1. Introduction (1 Page): Provide a brief overview of the theories and models relevant to your topic.2. Literature Review (2-4 pages): Summarize relevant and related research in classified way3. Statement of the Problem (1 Page): Identify research gaps based on the Literature Review and justify the conduct of the study4. Significance/Rationale (1/2 Page): Explain the importance and contribution of the findings5. Objectives: List the objectives (min 4) (1/2 page)6. Hypotheses/Research Questions: State your expectations from the dissertation (1/2 page)7. Methodology: Specify whether the project is Experimental, Theoretical/Mathematical Modelling, Survey based, or a combination, Design of Experiment (DoE), Describe the strategy and framework proposed, Indicate if the approach is quantitative, qualitative, or mixed methods. (1 Page)		



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8. Time Frame of Dissertation: Provide timeline of the work 9. Budget: Provide Budget (if required) 10. List of References		
Unit II	Submission of Synopsis and its Presentation	30hrs
Student is required to present his/her synopsis in front of Committee of the Department		

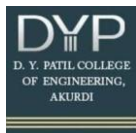
Rubrics for Continuous Evaluation

Rubrics for CCA (100)		
No	Component	Marks
1	Complete Submission of Synopsis in hard copy of 5 sets	70
2	Seminar presentation on Synopsis	30

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	2	3	2
CO2	3	3	3	2	3	2

3: High, 2: Moderate, 1: Low, 0: No Mapping



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Category: Dissertation Phase

Course Code: VES2411P02

Course Title: Dissertation Phase II

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory % Marks		Practical % Marks		
					Max	Min for Pass	Max	Min for Pass	
0	0	8	4	CCA	-	-	50	-	40
-	0	104	Total: 104	ESE	-	-	50	-	

Prerequisites: Submission of Synopsis

Course Objectives:

To present the dissertation work

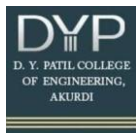
Course Outcome: After successful completion of the course the student will be able to

CO1 Construct the Synopsis on the Dissertation topic considering Statement of Problem, Significance, Objective, Hypothesis and Methodology.

CO2 Demonstrate the Synopsis on the Dissertation topic with Classified Literature Review, Rationale, Research Question, Time Frame, Budget and References.

Syllabus

Unit I	Submission of Report	70 hrs
1. Introduction 2. Literature Review 3. Statement of the Problem 4. Significance/Rationale 5. Objectives 6. Hypotheses/Research Questions 7. Methodology 8. Results and Discussions 9. Summary of Objectives Completed (50 % should complete) 10. List of References		
Unit II	Submission of Report and its Presentation	30 hrs
Student is required to present his/her work in front of Internal and External Committee of the Department		



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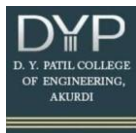
Rubrics for Continuous Evaluation

Rubrics for CCA and ESE (100)		
No	Component	Marks
1	Complete Submission of Report in hard copy	70
2	Presentation on the work in front of Internal and External Committee appointed by Department.	30

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	2	3	2
CO2	3	3	3	2	3	2

3: High, 2: Moderate, 1: Low, 0: No Mapping



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SY M Tech VLSI and Embedded Systems, Semester III

Category: Open Elective

Course Code: VES2411L01

Course Title: Optimization Techniques

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory % Marks			Practical % Marks	
					Max	Min for Pass	40	-	Min for Pass
3	1	0	4	CCA	50	20	40	-	-
Total Hours									
39	13	0	Total: 52	ESE	50	20			

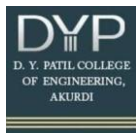
Prerequisites: linear algebra, vector calculus, ordinary differential equations, and Probability

Course Objectives:

1. To comprehend, anticipate, and formulate the design problem using mathematical Modeling.
2. To search for solutions to reach the best objective under certain constraints in all Engineering areas.
3. To maximize or minimize the numerical value for optimizing operations (objective function) with some linear and non-linear constraints.
4. To optimize a problem iteratively trying to improve a candidate solution with regard to a given measure of quality.

Course Outcomes: After successful completion of the course the student will be able to:

CO1	Formulate the design problem using mathematical Modeling.
CO2	Search for solutions to reach the best objective under certain constraints in all Engineering areas.
CO3	Compute the linear and non-linear programming through various optimization techniques.
CO4	Analyze and appreciate variety of performance measures for various optimization problems.
CO5	Formulate and design topology and Evolutionary based Structural Optimization to get optimum structural shape and layout.

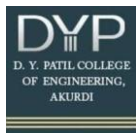


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Syllabus

Unit I	Title: Introduction to Mathematical Modeling	7 hrs
Introduction to Mathematical Modeling, Types of Modeling. Objective function; Constraints and Constraint surface; Mathematical modeling characteristics and limitations, Formulation of design problems.		
Unit II	Title: Classical Optimization Techniques	8 hrs
Engineering applications of optimization, classification of optimization problem, single variable optimization, multi variable optimization with no constraint, equality constraint, inequality constraint		
Unit III	Title: Linear and Non-Linear Programming	8 hrs
Simplex algorithm, two phases of the simplex method, Primal-dual simplex method, Sensitivity or post optimality analysis, applications in engineering. One-dimensional minimization - exhaustive search, golden section method, quasi-newton method, random search methods, Powell's method		
Unit IV	Title: Modern Methods of Optimization	8 hrs
Genetic algorithms, Simulated Annealing, Particle Swarm Optimization, Ant Colony Optimization, Teaching Learning Based Optimization, Introduction to ANN		
Unit V	Title: Topology and Evolutionary Structural Optimization	8 hrs
Problem formulation and parameterization of design, solution methods, topology optimization as a design tool, combining topology and shape design, ESO Based on Stress Level, evolutionary methods, two-bar frame, Michell type structure, ESO for stiffness or displacement optimization		
Reference Books		
1. Structural Optimization, Raphael T. Haftka and Zafer Gurdal, Kluwer Academic Publishers 2. Practical Optimization Methods with Mathematical Applications, M. Asghar Bhatti, Springer 3. Topology Optimization – Theory, Methods and Applications, M. P. Bendse, Q. Sigmund 4. Evolutionary Topology Optimization of Continuum Structures, Methods and Applications, X. Huang, Y.M. Xie, Wiley, 2010		

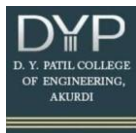


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5. Engineering Optimization: Theory and Practice, Singiresu S. Rao, John Wiley & Sons
6. Mathematical Modelling, J N Kapur, New age international publication
7. Optimization for engineering design, K. Deb, PHI
8. Optimization concepts and applications in engineering, Belegundu, Chandrupatla, Pearson Education.

Tutorial

Unit I	Title: Introduction to Mathematical Modeling	3 hrs												
Q.1 Formulation of Design Problems Using Mathematical Models														
<p>Given a manufacturing company is looking to optimize its production process for maximum profit. The company produces two products, A and B, using limited resources. The production of each product requires time on two machines, Machine 1 and Machine 2. The time required for each product on both machines, along with the available machine hours, is as follows:</p>														
<table><tr><th>Product</th><th>Machine 1 (hours)</th><th>Machine 2 (hours)</th><th>Profit per unit</th></tr><tr><td>A</td><td>3</td><td>4</td><td>40</td></tr><tr><td>B</td><td>2</td><td>3</td><td>30</td></tr></table>			Product	Machine 1 (hours)	Machine 2 (hours)	Profit per unit	A	3	4	40	B	2	3	30
Product	Machine 1 (hours)	Machine 2 (hours)	Profit per unit											
A	3	4	40											
B	2	3	30											
<p>The available hours for Machine 1 and Machine 2 are 24 hours and 18 hours per day, respectively.</p>														
<p>(a) Formulate the problem as a mathematical optimization model.</p> <ul style="list-style-type: none">• Define the decision variables.• Write the objective function to maximize the total profit.• Write the constraints on the availability of machine hours.• Discuss the characteristics and limitations of this mathematical model.														
Q.2 Understanding Objective Functions, Constraints, and Modeling Characteristics														
<p>Consider a problem where an agricultural company is determining the optimal mix of two types of fertilizers, F1 and F2, to maximize crop yield. Each type of fertilizer provides a different increase in yield per hectare, but they also require a limited budget and land availability. The characteristics of the fertilizers are as follows:</p>														



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Fertilizer	Yield per hectare (kg)	Cost per hectare (USD)
F1	200	50
F2	300	60

The company has a total budget of 3,000 USD and 20 hectares of land available for fertilizer application.

(a) Write the mathematical model for this optimization problem.

- Define the decision variables.
- Write the objective function to maximize the crop yield.
- Write the constraints based on the budget and land availability.

(b) Explain how the objective function and constraints affect the formulation of this mathematical model. Discuss the modeling characteristics (such as linearity, convexity, etc.) and limitations (e.g., assumptions about uniformity in yield and costs) in the context of this problem.

Unit II	Title: Classical Optimization Techniques	3 hrs
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Q.1 Single Variable Optimization (No Constraints)

An engineer is designing a cylindrical tank and wants to minimize the surface area for a given volume. The volume of the tank is fixed at 1000 cubic meters. The surface area A of a cylinder is given by:

$$A = 2\pi r^2 + 2\pi rh$$

where r is the radius and h is the height of the cylinder. Using the constraint $V = \pi r^2 h = 1000$, express the surface area as a function of r only and find the value of r that minimizes the surface area.

(a) Derive the surface area function in terms of r .

(b) Find the radius r that minimizes the surface area.

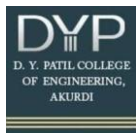
Q.2 Multi-variable Optimization with No Constraints

An engineer is designing a box with a square base and open top. The material used for the box costs \$2 per square meter for the base and \$1 per square meter for the sides. Let the side length of the square base be x meters and the height of the box be h meters. The volume of the box must be 100 cubic meters.

(a) Express the cost function for the material as a function of x and h .

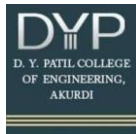
(b) Use the volume constraint $V=x^2h=100$ to eliminate h and find the cost function in terms of x alone.

(c) Find the value of x that minimizes the cost of material.



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Unit III	Title: Linear and Non-Linear Programming			3 hrs												
Q.1 Linear Programming and Simplex Method																
A company manufactures two products, P1 and P2 , which require two types of resources: R1 and R2 . The resource availability and requirements are as follows:																
<table><tr><th>Resource</th><th>Product P1 (units)</th><th>Product P2 (units)</th><th>Availability</th></tr><tr><td>R1</td><td>3</td><td>2</td><td>12</td></tr><tr><td>R2</td><td>4</td><td>3</td><td>18</td></tr></table>					Resource	Product P1 (units)	Product P2 (units)	Availability	R1	3	2	12	R2	4	3	18
Resource	Product P1 (units)	Product P2 (units)	Availability													
R1	3	2	12													
R2	4	3	18													
The profit per unit of P1 is \$4, and the profit per unit of P2 is \$5.																
(a) Formulate the problem as a linear programming problem.																
<ul style="list-style-type: none">Define the decision variables.Write the objective function to maximize profit.Write the constraints based on the resource limitations.																
(b) Solve the linear programming problem using the Simplex method.																
<ul style="list-style-type: none">Set up the initial simplex tableau.Apply the two-phase simplex method if necessary.Find the optimal solution and interpret the results.																
(c) Discuss the applications of sensitivity analysis in this problem. How would changes in the availability of resources (R1 or R2) affect the optimal solution?																
Q.2 Non-Linear Programming and One-Dimensional Minimization																
An engineer is optimizing the temperature of a heat treatment process, where the time dependent temperature $T(t)$ is modeled as a non-linear function of time. The temperature is given by:																
$T(t) = t^2 - 6t + 11$																
The engineer wants to minimize the temperature function over the time interval $t \in [0,5]$.																
(a) Use the Golden Section Method to find the minimum temperature in the given interval.																
<ul style="list-style-type: none">Explain the steps involved in the Golden Section method.Perform the necessary calculations to find the minimum point.																



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(b) Discuss the application of Quasi-Newton methods in solving non-linear optimization problems like the temperature optimization. What advantages do these methods have over traditional methods like exhaustive search?

(c) Explain how the Powell's method could be applied to a multi-variable optimization problem in an engineering design context, and discuss its potential benefits compared to gradient-based methods.

Unit IV	Title: Modern Methods of Optimization	2 hrs
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Q.1 Genetic Algorithms and Simulated Annealing

You are tasked with optimizing the design of a mechanical component to minimize the material usage while adhering to certain constraints (e.g., weight, strength). The objective function and constraints are complex, and traditional methods are not effective.

(a) Briefly explain how Genetic Algorithms (GA) can be used to solve this optimization problem. Highlight the key components of a GA (such as selection, crossover, and mutation).

(b) Compare Simulated Annealing (SA) with Genetic Algorithms (GA) in terms of their working principles and suitability for solving optimization problems with complex objective functions.

Q.2 Particle Swarm Optimization and Ant Colony Optimization

A civil engineering company is looking to optimize the layout of an urban road network to minimize congestion while considering traffic flow, safety, and construction costs.

(a) Explain the basic concept of Particle Swarm Optimization (PSO). How can PSO be applied to optimize the layout of road networks?

(b) Describe how Ant Colony Optimization (ACO) can be applied to solve optimization problems in transportation or logistics. Provide an example of its potential application in an engineering context.

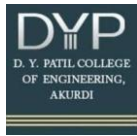
Unit V	Title: Topology and Evolutionary Structural Optimization	2 hrs
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Q.1 Topology Optimization and Design Parameterization

You are tasked with optimizing the design of a **two-bar frame** structure to minimize its weight while maintaining structural strength. The design is parameterized using the cross-sectional areas of the bars.

(a) Explain how Topology Optimization can be used to determine the optimal distribution of material in the two-bar frame. What are the key steps involved in the optimization process?

(b) Discuss how evolutionary methods can be applied to improve the design further, particularly when considering constraints on displacement and stress levels.

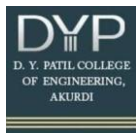


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Q. 2 ESO and Structural Optimization

A mechanical engineer is using **Evolutionary Structural Optimization (ESO)** for stiffness optimization in a structure. The engineer aims to reduce the structure's material usage while ensuring that the stiffness is above a certain threshold.

- (a) Describe the basic working principle of ESO based on stress level. How does this method help in removing inefficient material from the structure?**
- (b) Explain the concept of Michell-type structures and discuss how ESO can be applied to optimize such structures for stiffness or displacement.**



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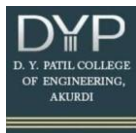
Rubrics for Continuous Evaluation

Component	Level	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Total	Process Evaluation
Continuous Comprehensive Assessment (CCA)	Faculty	10	10	10	10	10	50	Refer CCA Guideline
End Semester Examination (ESE)	Institute	10	10	10	10	10	50	Each Unit Carries 10 marks Question

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	3	2	1
CO2	3	2	2	3	2	1
CO3	3	2	2	3	2	1
CO4	3	2	2	3	2	1
CO5	3	2	2	3	2	1

3: High, 2: Moderate, 1: Low, 0/-: No Mapping



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SY M Tech VLSI and Embedded Systems, Semester III

Category: On Job Training

Course Code: VES2411P03

Course Title: On Job Training/Internship

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory % Marks		Practical % Marks		
					Max	Min for Pass	Max	Min for Pass	
0	0	20	10	CCA	-	-	100	-	40
-	0	60	Total: 60	ESE	-	-	-	-	

Prerequisites: NIL

Course Objectives:

1. To Investigate Different Industries and Career Paths
2. To Develop a Professional Network
3. To Apply Academic Knowledge in a Professional Setting
4. To Enhance Time Management and Communication Skills
5. To Increase Employment Opportunities

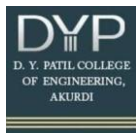
Course Outcome: After successful completion of the course the student will be able to

CO1 Investigate Various Industries and Employability Opportunities through Internship.

CO2 Develop Professional Network through effective communication.

Syllabus

Unit I	Internship	60hrs
The student is expected to complete an internship in an industry related to the PG program, working at least 6 hours a day for a minimum of 3 weeks. This internship should take place after the end of Semester II and before the commencement of Semester III, after the examinations. The evaluation will be carried out in Semester III. The student must submit a daily report electronically to his/her supervisor. At the end of the internship, the student will submit a comprehensive final report.		
Unit II	Submission of Report on Internship	-hrs
Student is required to submit report on internship work to his/her supervisor.		



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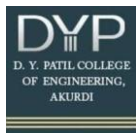
Rubrics for Continuous Evaluation

Rubrics for CCA and ESE (100)		
No	Component	Marks
1	Progressive Weekly Assessment of Internship work (25 x 3 weeks)	75
2	Complete Submission of Internship Report in hard copy	25

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	2	3	2
CO2	3	3	3	2	3	2

3: High, 2: Moderate, 1: Low, 0: No Mapping

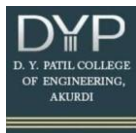


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SY M Tech VLSI and Embedded Systems, Semester IV

Syllabus Structure

Course Code	Course	Teaching Scheme				Evaluation Scheme					
		L	T	P	Cr	Exam	Theory % Marks			Practical % Marks	
							Max	Min for Pass		Max	Min for Pass
VES2412P01	Dissertation Phase III	0	0	20	10	CCA	-	-	-	100	40
VES2412P02	Dissertation Phase IV	0	0	24	12	CCA	-	-	-	50	20
						ESE	-			50	20
Total		0	0	44	22						



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SY M Tech VLSI and Embedded Systems, Semester IV

Category: Dissertation Phase

Course Code: VES2412P01

Course Title: Dissertation Phase III

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory % Marks		Practical % Marks		
					Max	Min for Pass	Max	Min for Pass	
0	0	20	10	CCA	-	-	-	100	40
0	0	260	Total: 260	ESE	-	-	-	100	40

Prerequisites: Completion of DP II

Course Objectives:

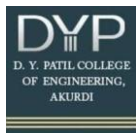
To prepare the report of the dissertation work

Course Outcome: After successful completion of the course the student will be able to

CO1	Construct the Progress Report on the Dissertation topic major focusing on Summary of Objectives Completed and Findings with discussions.
CO2	Demonstrate the Progress Report on the Dissertation topic with major findings and their discussions.

Syllabus

Unit I	Submission of Progress Report	70 hrs
1. Introduction 2. Literature Review 3. Statement of the Problem 4. Significance/Rationale 5. Objectives 6. Hypotheses/Research Questions 7. Methodology 8. Results and Discussions 9. Summary of Objectives Completed (More than 75 % should complete) 10. List of References		
Unit II	Submission of Progress Report and its Presentation	30 hrs
Student is required to present his/her synopsis in front of Committee of the Department		



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Department of Electronics and Telecommunication

SY M Tech VLSI and Embedded Systems, Semester IV

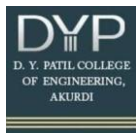
Rubrics for Continuous Evaluation

Rubrics for CCA (100)		
No	Component	Marks
1	Submission of Report in hard copy	70
2	Presentation on Dissertation Work	30

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	2	3	2
CO2	3	3	3	2	3	2

3: High, 2: Moderate, 1: Low, 0: No Mapping



D Y Patil College of Engineering, Akurdi, Pune
An Autonomous Institute from AY 2024-25, Affiliated to Savitribai Phule Pune University, Pune
Department of Electronics and Telecommunication

SY M Tech VLSI and Embedded Systems, Semester IV

Category: Dissertation Phase

Course Code: VES2412P02

Course Title: Dissertation Phase IV

Teaching Scheme				Evaluation Scheme				
L	T	P	Cr	Exam	Theory % Marks		Practical % Marks	
					Max	Min for Pass	Max	Min for Pass
0	0	8	4	CCA	-	-	50	40
-	0	104	Total: 104	ESE	-	-	50	

Prerequisites: Completion of DP III

Course Objectives:

To prepare the final report of the dissertation work

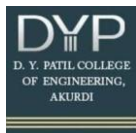
Course Outcome: After successful completion of the course the student will be able to

CO1 Construct the Final Report on the Dissertation major focusing on Summary of Objectives Completed and Findings with discussions.

CO2 Demonstrate the Final Report on the Dissertation with major findings and their discussions.

Syllabus

Unit I	Submission of Final Report	70 hrs
<ol style="list-style-type: none">1. Introduction2. Literature Review3. Statement of the Problem4. Significance/Rationale5. Objectives6. Hypotheses/Research Questions7. Methodology8. Results and Discussions9. Summary of Objectives Completed (100 % should complete)10. List of References11. List of Papers Published12. Vita <p>Student is expected to publish a paper in the SCI/SCOPUS indexed Journal and Present the work in reputed conferences on his/her dissertation work.</p>		
Unit II	Submission of Final Report and its Presentation	30 hrs
Student is required to present his/her work in front of Internal and External Committee of the		



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Department

Rubrics for Continuous Evaluation

Rubrics for CCA and ESE (100)		
No	Component	Marks
1	Complete Submission of Final Report in hard copy (4 Sets)	70
2	Presentation on the final work in front of Internal and External Committee appointed by Department.	30

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	2	3	2
CO2	3	3	3	2	3	2

3: High, 2: Moderate, 1: Low, 0: No Mapping
