Government of Karnataka
Department of Technical Education
Board of Technical Examinations, Bengaluru

Course Title **: Organisational Management and Entrepreneurship**	Course Code: **15EC51T**
Semester : **5**	Course Group: **Core**
Teaching Scheme in Hrs (L:T:P) : **4:0:0**	Credits : **4**
Type of course: **Lecture + Activity**	Total Contact Hours: **52**
CIE : **25 Marks**	SEE : **100 Marks**

Prerequisites

Knowledge of English communication and professional ethics.

Course Objectives

1. To learn basic management skills required for Technicians who are normally expected to work middle-level management.
2. To learn skills for optimum utilization of the resources to achieve higher productivity is essential for any electronic industry. Further, learn to practice quality control & cost control, and Safety standards.
3. To focus on Entrepreneurships and employment.

Course Outcomes

On completion of the course, students will be able to-

1. Develop and acquire Inter-personal skills, management skills, familiarize with different leadership styles and team building.
2. Understand the stages in production, production types, productivity, purchasing and PPC functions, Manage stores, logistics and Inventories.
3. Explain the different types of Plant maintenance. Explain the need of Total Quality Management and appreciate the usage of TQM tools in quality control.
4. Understand Industrial safety, accidental causes and preventive measures, role of safety officers; know the Indian factory act 1948.
5. Develop Entrepreneurship ideas in young minds, ability to present good project reports.
6. Create awareness about employment opportunities, sources of recruitment, methodology and psychometric tests.

Course Outcome		CL	Linked PO	Teaching Hrs
CO1	Develop and acquire Inter-personal skills, major management skills, familiarize with different leadership styles and team building.	***R/U/A***	5,7,8,9,10	**06**
CO2	Understand the stages in production, production types, productivity, purchasing and PPC functions, Manage stores, logistics and Inventories	***R/U/A***	1,4,6,8,10	**12**
CO3	Explain the different types of Plant maintenance. Explain the need of Total Quality Management and appreciate the usage of TQM tools in quality control	***R/U/A***	4,6,7,8,10	**10**
CO4	Understand Industrial safety, accidental causes and preventive measures, role of safety officers, know the Indian factory act 1948	***R/U/A***	3,5,7,8,9,10	**08**
CO5	Develop Entrepreneurship ideas in young minds, ability to present good project reports	***R/U/A***	2,5,7,8,9,10	**10**

		/E		
CO6	Create awareness about employment opportunities, sources of recruitment, methodology and psychometric tests.	***R/U/A /C***	1,2,7,8,9,10	**06**
			Total sessions	**52**

Legends: PO-Program Outcome, CO-Course Outcome, CL-Cognitive Level, R-Remember, U-Understand, A-Apply,E- Evaluation, C-Creation

Mapping Course Outcomes with Program Outcomes

Course Outcomes	**Programme Outcomes**									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	--	--	--	--	*	--	*	*	*	*
CO2	*	--	--	*	--	*	--	*	--	*
CO3	--	--	--	*	--	*	*	*	--	*
CO4	--	--	*	--	*	--	*	*	*	*
CO5	--	*	--	--	*	--	*	*	*	*
CO6	*	*	--	--	--	--	*	*	*	*

***Legend**: * Linked, -- No link*

P01-Basic Knowledge P02-Discipline knowledge P03-Experiments and practice P04-Engineering tools P05-Engineer and society P06- Environment and sustainability P07-Ethics P08-Individual and team work P09-Communication P10-life-long learning

Course-PO Attainment Matrix

Course	**Programme Outcomes**									
	1	2	3	4	5	6	7	8	9	10
Organisational Management and Entrepreneurship	**2**	**2**	**1**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

***Legend**: Addressing levels: 1-Slight, 2-Moderate, 3-Substantial, -- Not addressed*

***Quantification Method:** This is to relate the level of PO with the number of hours devoted to the COs which address the given PO. If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3; if 25 to 40% , Level 2; if 5 to 25%, Level 1; and if < 5%, not addressed.*

Course content and pattern of marks for SEE

Unit No	Unit Name	Hour	Questions to be set ForSEE					Marks Weightage	Weightage (%)
			R	U	A	E	C		
1	Management Skills	06	05	05	05	--	--	15	10.34
2	Production and Material Management	12	05	20	10	--	--	35	24.15
3	TPM and TQM	10	05	10	15	--	--	30	20.69
4	Organisational Safety	08	05	05	10	--	--	20	13.79
5	Entrepreneurship	10	05	10	10	05	--	30	20.69
6	Employment	06	--	05	05	--	05	15	10.34
	Total	**52**	**25**	**55**	**55**	**05**	**05**	**145**	**100**

Legend: R- Remember, U-Understand A-Application, E- Evaluation, C-Creation

Course Content

Unit 1: Management Skills Duration:06Hrs

Interpersonal skills-Know yourself and know others. SWOT analysis and its features. Intergroup communications. Art and barriers of communication. Functions, qualities and styles of leadership, Team and group- team building, comparison of team and group. Management - Definition, Henry-Fayol's principles of management, functions of management, managerial qualities. Management skills applicable to private, public and Govt. sectors.

Unit 2:Production and Material Management Duration:12Hrs

Product- Stages and factors to be considered in product design, types of production and their characteristics. Productivity-Factors to improve productivity, "Six lines of attack" to improve productivity. Production, Planning & Control (PPC). Make or Buy Decision-Simple cost analysis and break-even analysis. Purchasing-Purchasing methods, steps involved in purchasing. Stores management- Methods of storing and tools required. Codification System. Logistics management-Different means of transportation, routing and delays, insurance. Inventory management- Techniques, functions of inventory control, inventory management software's. Introduction to MRP and ERP.

Unit 3: TPM and TQM Duration:10Hrs

Total Preventive Maintenance (TPM) - Concept, techniques and benefits of TPM. Components of maintenance. Economics of preventive maintenance and breakdown maintenance.

Inspection-types of inspection. TQM- Quality, factors affecting quality, relation between quality and cost. Quality control. TQM Tools-Flow-chart, control charts, histograms, Pareto charts, Kaizen and six-sigma. Quality circle and objectives of quality circle. ISO 9000- series quality standards, procedure to attain ISO registration, characteristics of ISO 9000, and areas covered by ISO 9000 series.

Unit 4: Organisational Safety Duration:08Hrs

Organisational safety – Accident, causes for industrial accident, direct and indirect losses due to an accident, and personal protective devices for preventions of accidents. Safety

organization- Duties of safety inspector, safety supervisor, general safety rules, accident reporting and crisis management. Fire- Prevention, protection and types of fire extinguishers**.** Safety provisions under Indian Factories Act - 1948.Safety Management System-OSHAS 18001.Features of 'Restriction of Hazardous Substances Directive (RoHS)'.

Unit 5: Entrepreneurship **Duration:10Hrs**

Concept of entrepreneur and entrepreneurship, need and qualities of an entrepreneur, factors influencing entrepreneurship, successful entrepreneurship, and entrepreneur motivation. Training for entrepreneurship development. Financing of enterprise, source of finance, market survey, market risk, project planning, project capacity, and preparation of project report. Industries- Classification of industries and their features, scope and role of small-scale industries, list of items reserved for small-scale sectors, procedure to start small-scale industry.

Unit 6: Employment **Duration:06Hrs**

Introduction to employment. Causes of unemployment, Employment opportunities- Govt. sector, public sector, private sector and MNCs. Areas- Technical, management, marketing and general. Employment- Searching, sources of recruitment-internal and external, application process, scientific selection process, written tests- objective and descriptive, group discussion, interviews- technical and personal, offers, promotions, transfers. Psychometric tests: Reasoning-verbal, numerical, logical and puzzles.

References

1. Industrial Organization and Engineering Economics, T.R.Banga& S C Sharma, Khanna Publishers
2. Industrial management and organizational behaviour, K.K.Ahuja
3. Industrial management and engineering economics, O.P.Khanna, Khanna publishers
4. Industrial Engineering and Production Management, M Mahajan, DhanpatRai and Co
5. Production and operations management, Dr.K.Aswathappa and Dr.Sreedhar Bhatt, Himalaya publishers
6. Safety Management in Industry, Krishnan.N V, Jaico Publishing House, Bombay, 1997
7. Total Quality Management, S Raja Ram, M Shivashankar
8. Soft Skills, Dr. K. Alex, S Chand & Company Ltd.
9. How to pass psychometric tests, Andrea Shavick, Howtobooks, ISBN: 97-1-84528-447-3
10. www.timesjobs.com/candidate/careerresources/htmls/interviewpreparing.jsp

Special Instructional Strategies

Unit No	Unit Name	Strategies
1	Management Skills	Teaching, presentations, Video movies
2	Production and Material Management	Presentations, Video movies, Expose to real life industries situation, industrial visits
3	TPM and TQM	Discussions, real life industries situation, industrial visits. Expose to practiced procedures
4	Organisational Safety	Teaching, Presentations, Industrial visits, movies.
5	Entrepreneurship	Teaching, Industrial visits, videos and movies

6	Employment	Teaching, Discussions, Practice sessions

Suggested List of Student Activities Duration: 4hrs

Note: The following activities or similar activities for assessing CIE (IA) for 5 marks (Any one)

Sl. No.	Activity
	1. Each student shall given an activity to prepare comparative statement, placing the purchase order with necessary terms and conditions 2. SWOT analysis case study / Example for industry/establishment 3. Given the data, prepare the scheduling using Gantt chart. 4. Identify any one product, being manufactured in local industry, Study the process they are following for manufacturing the product, submit hand written report. 5. Visit a nearby industry, make a report on Plant layout, type of production, quality system is put in practice and quality tools they are using in work place 6. Motivate student to take case study on plant maintenance of nearby industry, observe what type of maintenance they undertake in their industry 7. Each student should prepare a detailed project report on selected product 8. Visit a local industry and list the safety precautions carried out there 9. Visit the local fire brigade station and prepare a suitable report. 10. Meet a local Entrepreneur and prepare a report on his success story **Execution Mode** 1. Maximum of 4 students in each batch should do any one of the following type activity or similar activity related to the course and before take up, get it approved from concerned Teacher. ***2.*** Each batch should conduct different activity and no repeating should occur. ***3.*** Submit a brief report on the activity done on 4-6 pages, A4 size handwritten paper. Papers should be simple stapled or tagged. **Avoid plastic** based files for submitting of reports. 4. Activities can be carried off-class or in the laboratory, as the case may be. 5. Assessment shall be made based on quality of activity/presentation/demonstration and report.

Institutional Activities

Note: One activity every month**.**

Sl. No.	Activity
1	Organize Seminar or Lecture from experts on Organisational Behaviour
2	Invite local Entrepreneurs and ask them to share their initial struggle and success story.
3	Invite experts to conduct Mock interviews, Group discussions and Psychology tests.

Course Delivery

The course will be delivered through lectures, presentations and support of modern tools.

Course Assessment and Evaluation Scheme

Assessment Method	What		To Whom	Assessment mode /Frequency /timing	Max. Marks	Evidence Collected	Course Outcomes
Direct assessment	CIE	IA	Students	Three tests+	20	Blue Books	1 to 6
				Activity*	05	Activity Sheets	1 to 6
	SEE	End exam		End of the course	100	Answer Scripts at BTE	1 to 6
				Total	125		
Indirect assessment	Student feedback on course		Students	Middle of the Course	Nil	Feedback Forms	1 to 3& Delivery of course
	End of course survey			End of the Course	Nil	Question-naires	1 to 6, Effectiveness of delivery instructions & assessment methods

Legends: CIE-Continuous Internal Evaluation, SEE- Semester End-exam Evaluation

+ Every I.A. test shall be conducted for 20 marks. Average of three tests, by rounding off any fractional part thereof to next higher integer, shall be considered for IA.

***S**tudents should do activity as per the list of suggested activities/ similar activities with prior approval of the teacher. Activity process must initiate well in advance so that it can be completed well before the end of the term and assessed through appropriate Rubrics.

Questions for CIE and SEE will be designed to evaluate the various CLs as per the weightage shown in the following table.

Sl. No.	Cognitive Levels (CL)	Weightage (%)
1	Remembering	18
2	Understanding	38
3	Applying	38
4	Evaluation	03
5	Creation	03
	Total	**100**

(i) Model of rubrics for assessing student activity (for every student)

Dimension	Scale					Marks (Example)
	1 Unsatisfactory	2 Developing	3 Satisfactory	4 Good	5 Exemplary	
1. Research and gathering information	Does not collect information relate to topic	Collects very limited information, some relate to topic	Collects basic information, most refer to the topic	Collects more information, most refer to the topic	Collects a great deals of information, all refer to the topic	3
2. Full-fills	Does not	Performs	Performs	Performs	Performs all	2

team roles and duties	perform any duties assigned to the team role	very little duties	nearly all duties	almost all duties	duties of assigned team roles	
3. Shares work equality	Always relies on others to do the work	Rarely does the assigned work, often needs reminding	Usually does the assigned work, rarely needs reminding	Always does the assigned work, rarely needs reminding.	Always does the assigned work, without needing reminding	5
4. Listen to other team mates	Is always talking, never allows anyone to else to speak	Usually does most of the talking, rarely allows others to speak	Listens, but sometimes talk too much,	Listens and talks a little more than needed.	Listens and talks a fare amount	3
					Total marks	ceil(13/4)= 4

(iii) CIE/IA Tests (20 Marks)

Three tests have to be conducted in accordance with the test pattern given below and average marks of them are considered for CIE/IA with specified schedule.

(iv) Format of CIE/IA test question paper

CIE Question Paper							
Institution Name and Code							
Course Co-ordinator/Teacher							
Program Name		***Test No.***		*Units*			
Class/Sem		*Date*		*CL*			
Course Name		*Time*		*COs*			
Course Code		*Max. Marks*		*POs*			
Note to students: Answer all questions							
Question No.	**Question**		Marks	**CL**	**CO**	**PO**	
1							
2							
3							
4							

Legends: PO-Program Outcome, CO-Course outcome, CL-Cognitive Level, R-Remember, U-Understand, A-Apply

Note: Internal choice may be given in each CO at the same cognitive level (CL).

(v) Model question paper for CIE

CIE Question Paper							
Institution Name and Code							
Course Co-ordinator/Teacher							
Program Name	Electronics & Communication	***Test No.***	1	*Units*	1 & 2		
Class/Sem	5thSem	*Date*	1/1/2017	*CL*	R/U/A		
Course Name	Organisational Management and Entrepreneurship	*Time*	10-11AM	*COs*	1 & 2		
Course Code	15EC51T	*Max. Marks*	20	*POs*	1, 2 & 3		
Note to students: Answer all questions							
No.	**Question**		Marks	**CL**	**CO**	**PO**	

1	Identify the barriers for effective communication OR List the advantages and limitations of planning	05	R	1	2,7,8,9 ,10
2	Explain with line diagram how Functional organisation will suit for pharmaceutical industry	05	A	1	2,7,8,9 ,10
3	Explain batch production and mention its advantages and disadvantages OR Explain routing procedure	05	U	2	2,7,8,9 ,10
4	Explain how the productivity of an organisation can be increased	05	A	2	2,7,8,9 ,10

Semester End-exam Evaluation (SEE)

(i) End-exam question-paper pattern

.Unit No.	Unit Name	Study Duration (Hrs.)	No. Questions for End-exam	
			5 marks Part - a	10 marks Part - b
1	Management Skills	**06**	01	01
2	Production and Material Management	**12**	01	03
3	TPM and TQM	**10**	02	02
4	Organisational Safety	**08**	02	01
5	Entrepreneurship	**10**	02	02
6	Employment	**06**	01	01
	Total	**52**	**09 (45 Marks)**	**10 (100 Marks)**

(ii) Model question paper

Course Title **: Organisational Management and Entrepreneurship**
Course Code **: 15EC51T** Time **: 3 Hrs**
Semester **: Fifth** Max. Marks**: 100**
Instructions*: 1. Answer any **SIX** question from **Part A** (5x6=30 Marks)*
*2. Answer any **SEVEN** full questions from **Part B** (7x10=70 Marks)*

Part A

1. List the various barriers of communication.
2. What is batch production and mention its advantages.
3. What are the benefits of TPM?
4. Discuss ISO 9000 series for quality management.
5. What are the different causes for industrial accidents?
6. Describe the duties of a safety supervisor.
7. List the qualities of an Entrepreneur.
8. Define Industry and classify it.
9. Write a note on employment opportunities.

Part B

1. What are the functions of leadership? Explain briefly.
2. Explain the various factors to improve the productivity.
3. Describe PPC technique.
4. What is store management? Explain the different tools used for stores management.
5. What is TQM? Explain Kaizen and Six sigma tools of TQM.
6. List the types of Inspection and explain.
7. Explain the safety provisions act under Indian factories act 1948.
8. What is financing? Explain sources of finance for starting an enterprise.
9. Explain the steps in preparation of a project report of an industry.
10. What are the different employment sectors? Explain them briefly.

Model Question Bank

Course Title : **Organisational Management and Entrepreneurship**	Course Code: **15EC51T**

UNIT-1Management Skills

05 Marks

Remember

1. State Henry Fayol's principles of management.
2. Write a note on Inter-personal skills.
3. Define Team and Team building.
4. Define management. List the functions of management.
5. List the features of different management sectors.

Understand

1. Compare Team and Group.
2. Explain the features of management in a Govt. Sector?
3. Explain management.
4. Explain qualities of a manager.
5. Explain intergroup communications.

Applying

1. Illustrate the importance of interpersonal skills..
2. Explain the Henry-Fayol's principles of management.
3. Illustrate the different styles of leadership with typical example.

10 Marks

Remember

1. Define Communication and list the art of communication.
2. List the functions of management and explain them.

Understand

1. Differentiate between private, public and Govt. Sector management
2. Explain the different characteristics of a team and group.

Applying

1. Illustrate the importance of intergroup communications and explain it.
2. Demonstrate the significance of Management in different sectors.

UNIT-2Production and Material Management

05 Marks

Remember

1. Define production and explain the needs for production
2. List the factors to improve productivity
3. Define production-planning and control and mention its needs
4. Define purchasing.list its methods
5. Define Codification and Logistics management
6. Define MRP and ERP
7. List the functions of inventory

Understand

1. Explain factor to improve productivity
2. Explain purchasing methods
3. Explain Logistic management
4. Explain inventory management software
5. Explain simple cost analysis
6. Explain break-even analysis
7. Explain MRP
8. Explain ERP

Applying

1. write the procedure for routing and delays
2. write the steps involved in PPC
3. write the procedure involved make or bye decision

10 Marks

Remember

1. Define transportation, routing, delay and insurance

Understand

1. Explain codification and logistics management system
2. Explain MRP and ERP
3. Explain stores management system
4. Explain PPC

Applying

1. Illustrate the methods of purchasing with an example
2. Using six-lines of attack method to improve the productivity
3. How productivity will improve using six-lines of attack method

UNIT-3TPM and TQM

05 Marks

Remember

1. Define TPM and TQM.
2. Define Inspection. List the types of inspection.
3. Define planned maintenance and predictive maintenance.
4. List the types of TQM tools.
5. List the characteristics of ISO 9000.
6. List the areas covered by ISO 9000 series.

Understand

1. Explain the concept of TPM.
2. Explain the concept of TQM.

3. Describe the benefits of TPM?
4. Describe the techniques of TPM.
5. Explain Histogram method of TQM.

Applying

1. Write the factors that affect quality.
2. Write the procedure to attain ISO registration.
3. Explain Pareto charts of TQM.
4. Explain ISO 9000 series quality standards.

10 Marks

Understand

1. Describe the TQM tools.
2. Describe the concepts of TPM.
3. Distinguish between Planned maintenance and predictive maintenance.
4. Describe Flowchart and control charts of TQM.
5. Describe Kaizen and six sigma TQM tools.
6. Describe Histogram and Pareto charts of TQM.

Applying

1. Write the factors that affect quality control.
2. Illustrate the different types of inspections.
3. Write the procedure to attain ISO registration and mention the areas covered by it.
4. Explain the use of Quality circle and its objectives.

UNIT-4 Organisational Safety

05 Marks

Remember

1. Define Organisational safety.
2. Define accident and its causes.
3. Mention the direct losses due to accident.
4. Mention the indirect losses due to accident.
5. Mention the duties of safety inspector.
6. Mention the general safety rules.
7. List types of fire extinguishers.

Understand

1. Describe organisational safety and its importance.
2. Explain direct losses due to accident.
3. Explain indirect losses due to accident.
4. Explain the benefits of safety organisation.
5. Describe the method of accident reporting.
6. Discuss Safety management system OSHAS-18001.
7. Discuss the features of RoHS.

Applying

1. Write the duties of safety supervisor.
2. Write the duties of safety inspector.
3. Illustrate the general safety rules.
4. Illustrate Fire prevention and protection.
5. Illustrate the safety provisions under Indian Factories Act – 1948.

10 Marks

Understand

1. Explain Organisational safety.
2. Describe the causes for industrial accidents.
3. Describe the different types of fire extinguishers.
4. Explain OHSAS 18001 and RoHS.

Applying

1. Illustrate the general safety rules.
2. Explain accident reporting and crisis management.
3. Illustrate the different protective devices for preventions of accidents.

UNIT-5Entrepreneurship

05 Marks

Remember

1. Define Entrepreneur and entrepreneurship.
2. List the qualities of an entrepreneur.
3. List the factors that influence entrepreneurship.
4. List the sources of financing of an enterprise.
5. Define industry and classify.
6. List the items reserved for small scale sectors.

Understand

1. Explain qualities of entrepreneur.
2. Explain project planning.
3. Explain entrepreneur motivation.
4. Explain scope and role of small scale industries.
5. Explain procedure to start a small scale industry.
6. Explain market survey and market risk.
7. Explain training for entrepreneurship development.
8. Explain the sources of financing to start an enterprise.

Applying

1. Write scope and role of small scale industries.
2. Write the qualities of an entrepreneur.
3. Write the steps involved in preparing of project report.
4. Classify industries and explain briefly.

Evaluation

1. Compare the different types of industries.
2. Evaluate the market risks involved in starting an enterprise.
3. Summarise the factors that influence entrepreneurship.

10 Marks

Understand

1. Explain the factors that influence entrepreneurship.
2. Explain the procedure for a successful entrepreneur.
3. Describe the steps involved in project planning and preparation of project report.
4. Describe small scale sectors and list the items reserved for it.
5. Explain the sources of finance to start an enterprise.

Applying

1. Illustrate the concept of entrepreneur and entrepreneurship.
2. Illustrate the various factor that influence entrepreneurship and entrepreneur motivation.
3. Write a note on market survey and market risks.
4. Write the procedure to start a small scale industry.

UNIT-6 Employment

05 Marks

Understand

1. Explain employment opportunities in Govt. sector.
2. Explain employment opportunities in private sector.
3. List the sources of internal recruitment
4. Explain Psychometric tests.

Applying

1. Write the different areas of employment opportunities.
2. Illustrate the procedures for scientific selection process.
3. Identify the causes of unemployment.

Create

1. Express the various areas of employment.
2. Express the method of Psychometric tests

10 Marks

Understand

1. Explain the Sources of recruitment.
2. Explain written tests, group discussions and Interviews.
3. Explain offers, promotions and transfers in employment.

End

Government of Karnataka
Department of Technical Education
Board of Technical Examinations, Bengaluru

Course Title **: ARM Controller**	Course Code: **15EC52T**
Semester : **5**	Course Group: **Core**
Teaching Scheme in Hrs (L:T:P) : **4:0:0**	Credits : **4**
Type of course: **Lecture + activity**	Total Contact Hours: **52**
CIE : **25 Marks**	SEE : **100 Marks**

Prerequisites

Knowledge of Digital electronics, Microcontroller Architecture and Programming

Course Objectives

1. Collect knowledge of architecture of ARM 7processor, LPC2148 and assembly programming of ARM.
2. Learn to design, construct, program, verify, analyze and troubleshoot ARM assembly and C language programs and supporting hardware.

Course Outcomes

At the end of the course, the students will be able to

1. Understand the features of embedded systems, architecture of ARM7 and applications.
2. Analyse and understand the instruction set and development tools of ARM
3. Analyse and understand the THUMB state and achieving competency in assembly programming of ARM.
4. Understand the exception, interrupts and interrupt handling schemes
5. Understand the architectural features of LPC2148 microcontrollers.
6. Understand the hardware and interfacing peripheral devices to LPC2148

Course Outcome		CL	Linked PO	Teaching Hrs
CO1	Understand the features of embedded systems, architecture of ARM7 and applications.	***R/U/AN***	2,9	**10**
CO2	Analyse and understand the instruction set and development tools of ARM	***U/A/AN***	1,2,3,4,9, 10	**10**
CO3	Analyse and understand the THUMB state and achieving competency in assembly programming of ARM.	***R/U/A/E/C***	1,2,3,4,9, 10	**8**
CO4	Understand the exception, interrupts and interrupt handling schemes	***R/U***	1,2,9,10	**7**
CO5	Understand the architectural features of LPC2148 microcontrollers.	***R/U***	1,2,9,10	**6**
CO6	Understand and Analyse the hardware and interfacing peripheral devices to LPC2148	***R/U/A/C***	1,2,3,4,9, 10	**11**
	Total sessions including 3Hours student activity			**52**

Legends: PO-Program Outcome, CO-Course Outcome, CL-Cognitive Level, R-Remember, U-Understand, A-Apply, AN-Analyse, E-Evaluate, C- Create

Mapping Course Outcomes with Program Outcomes

Course Outcomes	Programme Outcomes									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	--	*	--	--	--	--	--	--	*	--
CO2	*	*	*	*	--	--	--	--	*	*
CO3	*	*	*	*	--	--	--	--	*	*
CO4	*	*	--	--	--	--	--	--	*	*
CO5	*	*	--	--	--	--	--	--	*	*
CO6	*	*	*	*	--	--	--	--	*	*

***Legend**: * Linked, -- No link*

Course-Po Attainment Matrix

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
ARM Controller	**3**	**3**	**3**	**3**	**--**	**--**	**--**	**--**	**3**	**3**

***Legend**: Addressing levels: 1-Slight, 2-Moderate, 3-Substantial, -- Not addressed*

***Quantification Method:** This is to relate the level of PO with the number of hours devoted to the COs which address the given PO. If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3; if 25 to 40% , Level 2; if 5 to 25%, Level 1; and if < 5%, not addressed.*

Course content and pattern of marks for SEE

Unit No	Unit Name	Hour	Questions to be set For SEE						Marks Weightage	Weightage (%)
			R	U	A	AN	E	C		
1	ARM Embedded Systems and ARM Processor Fundamentals	8	05	10	05	05	--	--	25	16
2	ARM Instruction Set	10	--	05	05	05	05	05	25	20
3	Introduction to THUMB and ARM Programming	7	05	05	05	--	--	05	20	14

4	Exception and Interrupt handling schemes	6	05	05	05	05	--	--	20	13
5	LPC2148 ARM CPU	6	05	05	10	--	--	--	20	12
6	LPC 2148 – Peripherals	12	05	10	15		05		35	25
	Total	**49**	**25**	**40**	**45**	**15**	**10**	**10**	**145**	**100**

Legend: R- Remember, U-Understand A-Application, AN-Analyse, E-Evaluate, C- Create

Course Content

Unit-1: ARM Embedded Systems and ARM Processor Fundamentals Duration:10 Hrs.

The RISC design philosophy, ARM design philosophy, embedded system hardware- AMBA bus protocol, embedded system software- applications. ARM core data flow model, Registers, CPSR-Processor modes, Banked registers. Pipeline- Characteristics.

Unit-2:ARM Instruction Set Duration: 10 Hrs.

Fundamentals of ARM instructions, Barrel shifter, Classification and explanation of instructions with examples-Data processing, Branch, Load-store, SWI and Program Status Register instruction.

Unit-3:Introduction to THUMB and ARM Programming Duration: 08 Hrs.

Introduction to THUMB, Differences between ARM and THUMB, Register usage in Thumb, ARM Thumb Interworking. General Structure of ARM assembly module, Assembler directives- AREA, ENTRY, END, SPACE, DCD, DCB, DCW, DCI, DCQ, EQU, EXPORT, ALIGN, CODE16, CODE32, DATA. Simple ALP programs on Arithmetic & logical operations, Factorial, string operation, sorting, searching, and Scan.

Unit-4:Exception and Interrupt handling schemes Duration: 07 Hrs.

Exception handling- ARM processor exceptions and modes, vector table, exception priorities, link register offsets. Interrupts- assigning interrupts, interrupt latency, IRQ and FIQ exceptions with example- code for enabling and disabling IRQ and FIQ exceptions, Comparison between exception and interrupts. Interrupt handling schemes- nested interrupt handler, non-nested interrupt handler. Basic interrupt stack design.

Unit-5: LPC2148 ARM CPU Duration: 06 Hrs.

LPC 2148 - Salient features, applications, block diagram, memory mapping. Functional features of Interrupt controller, RTC, USB, UART, I2C, SPI, SSP controllers, watch dog timers and other system control units.

Unit-6:LPC 2148 – Peripherals Duration: 11 Hrs.

Pin Connect Block- Features, Register description with example. **GPIO-**Features, Applications, Pin description, Register description with examples **PLL-**Features, block diagram, bit structure of PLLCON, PLLCFG, & PLLSTAT, and PLLFEED. PLL frequency Calculation- procedure for determining PLL settings, examples for PLL Configuration **Timers-**Features, applications, Architecture of timer module, register description, Simple C programs for application using -GPIO, PLL, Timer.

Note:

1. **Pin diagram of LPC 2148 is only for reference.**
2. **Pin descriptions of all Peripherals are only for reference.**

References

1. ARM System Developer's guide –Andrew N. SLOSS, ELSEVIER Publications,ISBN 978-81-8147-646-3, 2016
2. ARM Assembly Language – William Hohl, CRC Press, ISBN:978-81-89643-04-1
3. ARM System-on-chip Architecture by Steve Furber, Pearson Education,ISBN978-81-317-0840-8, 2E,2012
4. LPC 2148 USER MANUAL
5. IN SIDE R'S GUIDE TO PHILIPS ARM7 BASED MICROCONTROLLERS-hitex.co.uk
6. ARM Programming Techniques – from ARM website
7. Embedded Systems: A Contemporary Design Tool- James K. PeckolISBN: 0-471-72180-2 October 2007, ©2008
8. www.Arm.com
9. **www.ocfreaks.com**
   http://www.ocfreaks.com/lpc2148-gpio-programming-tutorial/
   http://www.ocfreaks.com/lpc214x-pll-tutorial-for-cpu-and-peripheral-clock/
   http://www.ocfreaks.com/lpc2148-timer-tutorial/
   http://www.ocfreaks.com/lpc2148-pwm-programming-tutorial/
   http://www.ocfreaks.com/lpc2148-adc-programming-tutorial/
   http://manish4u.com/interfacing-of-dac-arm-lpc2148/

Course Delivery

The course will be delivered through lectures, presentations and support of modern tools.

Course Assessment and Evaluation Scheme

Assessment Method	What		To Whom	Assessment mode /Frequency /timing	Max. Marks	Evidence Collected	Course Outcomes
Direct assessment	CIE	IA	Students	Three tests+	20	Blue Books	1 to 6
				Activity*	05	Activity Sheets	1 to 6
	SEE	End exam		End of the course	100	Answer Scripts at BTE	1 to 6
				Total	125		
Indirect assessment	Student feedback on course		Students	Middle of the Course	Nil	Feedback Forms	1 to 3& Delivery of course
	End of course survey			End of the Course	Nil	Question-naires	1 to 6, Effectiveness of delivery instructions & assessment methods

Legends: CIE-Continuous Internal Evaluation, SEE- Semester End-exam Evaluation

+ Every I.A. test shall be conducted for 20 marks. Average of three tests, by rounding off any fractional part thereof to next higher integer, shall be considered for IA.

***S**tudents should do activity as per the list of suggested activities/ similar activities with prior approval of the teacher. Activity process must be initiated well in advance so that it can be completed well before the end of the term and assessed through appropriate Rubrics.

Questions for CIE and SEE will be designed to evaluate the various CLs as per the weightage shown in the following table.

Sl. No.	Cognitive Levels (CL)	Weightage (%)
1	Remembering	17
2	Understanding	28
3	Applying	31
4	Analyse	10
5	Evaluate	07
6	Create	07
	Total	**100**

Continuous Internal Evaluation (CIE) pattern

(i) Student Activity (5 marks)

The following student activities or similar activities can be assigned for assessing CIE (IA) marks

Sl. No.	Activity
1	Collect data on (i) ARM variants (ii) ARM processor cores likeARM7, ARM9, ARM10, ARM11, SA and Cortex processors (iii)After collecting the data make compression between each.
2	Prepare a report on pin functions of LPC2148
3	Prepare a report on USB controller, UART, I2C, SPI, SSP and so on
4	Prepare a report on ARM products, Embedded ARM applications.

Note: 1. Every student should perform either one of the above activities independently as assigned by the teacher based on interest of the student. Student can also choose any other similar activity with a prior approval from the concerned teacher.

2. Teacher is expected to observe and record the progress of students' activities

3. Assessment is made based on quality of work as prescribed by the following rubrics table.

(ii) Model of rubrics for assessing student activity

Dimension	Scale					Marks (Example)
	1 Unsatisfactory	2 Developing	3 Satisfactory	4 Good	5 Exemplary	
1. Research and gathering information	Does not collect information relate to topic	Collects very limited information, some relate to topic	Collects basic information, most refer to the topic	Collects more information, most refer to the topic	Collects a great deals of information, all refer to the topic	3
2. Full-fills team roles and duties	Does not perform any duties assigned to the team role	Performs very little duties	Performs nearly all duties	Performs almost all duties	Performs all duties of assigned team roles	2
3. Shares work equality	Always relies on others to do the work	Rarely does the assigned work, often needs reminding	Usually does the assigned work, rarely needs reminding	Always does the assigned work, rarely needs reminding.	Always does the assigned work, without needing reminding	5
4. Listen to other team mates	Is always talking, never allows anyone to else to speak	Usually does most of the talking, rarely allows others to speak	Listens, but sometimes talk too much,	Listens and talks a little more than needed.	Listens and talks a fare amount	3
					Total marks	ceil(13/4) = 4

Institutional Activities

Sl. No.	Activity
1	Organize Seminar, workshop or Lecture from experts on ARM embedded application/ Cortex processor
2	Organize workshop on USB controller, UART, I2C from experts

(iii) CIE/IA Tests (20 Marks)

Three tests have to be conducted in accordance with the test pattern given below and average marks of them are considered for CIE/IA with specified schedule.

(iv) Format of CIE/IA test question paper

CIE Question Paper								
Institution Name and Code								
Course Co-ordinator/Teacher								
Program Name		***Test No.***		*Units*				
Class/Sem		*Date*		*CL*				
Course Name		*Time*		*COs*				
Course Code		*Max. Marks*		*POs*				
Note to students: Answer all questions								
Question No.	**Question**			Marks	**CL**	**CO**	**PO**	
1								
2								
3								
4								

Legends: PO-Program Outcome, CO-Course outcome, CL-Cognitive Level, R-Remember, U-Understand, A-Apply
Note: Internal choice may be given in each CO at the same cognitive level (CL).

(v) Model question paper for CIE

CIE Question Paper					
Institution Name and Code					
Course Co-ordinator/Teacher					
Program Name	Electronics and Communication	***Test No.***	1	*Units*	1 & 2
Class/Sem	5thSem	*Date*		*CL*	R/U/A/AN/E/C
Course Name	ARM Controller	*Time*		*COs*	1 & 2
Course Code	15EC52T	*Max. Marks*	20	*POs*	1, 2 ,3,4,9,10

Note to students: Answer all questions

No.	Question	Marks	CL	CO	PO
1	List the special features of ARM processor design. OR Discuss the process of filling the pipeline with a neat sketch.	05	R/A	1	2
2	Explain the active registers used in user mode.	05	U	1	2
3	Explain Barrel shifter with a neat sketch. OR Predict the operation performed by the execution of each compare instruction.	05	U/AN	2	1,2,3,4
4	Explain stack operation using STM & LDM instructions.	05	A	2	1,2,3,4

Semester End-exam Evaluation (SEE)

(i) End-exam question-paper pattern

.Unit No.	Unit Name	Study Duration (Hrs.)	No. Questions for End-exam	
			5 marks Part - a	10 marks Part - b
I	ARM Embedded Systems and ARM Processor Fundamentals	8	1	2
II	ARM Instruction Set	10	1	2
III	Introduction to THUMB and ARM Programming	7	2	1
IV	Exception and Interrupt handling schemes	6	2	1
V	LPC2148 ARM CPU	6	2	1
VI	LPC 2148 – Peripherals	12	1	3
	Total	**49**	**09 (45 Marks)**	**10 (100 Marks)**

(ii) Model question paper

Course Title **: ARM Controller**
Course Code **:15EC52T** Time **: 3 Hrs**
Semester **: Fifth** Max. Marks**: 100**
Instructions*: 1. Answer any **SIX** question from **Part A** (5x6=30 Marks)*
*2. Answer any **SEVEN** full questions from **Part B** (7x10=70 Marks)*

1. List the special features of ARM processor design.
2. Explain conditional execution with an example.

3. Describe the function of ENTRY, EXPORT, and AREA assembler directives
4. Explain register usage in thumb.
5. List various interrupt handling schemes.
6. Write a note on exception priorities.
7. List any 5 features of LPC2148
8. Write a note on APB bus
9. Sketch a neat block diagram of PLL.

Part B

1. Explain ARM core data flow model.
2. a) Discuss the process of filling the pipeline with a neat sketch.
   b) Justify the features that improves code density
3. a)Explain Barrel shifter with a neat sketch.
   b) Calculate the effective address of the following instructions if register R3=0x4000 and register R4=0x20
      (i) STRH R9,[R3,R4]
      (ii) LDRB R8,[R3,R4,LSL #3]
      (iii)LDR R7,[R3],R4
      (iv)STRB R6,[R3],R4,ASR #2
      (v) LDR R0,[R3,-R4,LSL #3]
4. a) Explain stack operation using STM & LDM instructions.
   b) Write the instruction to perform the following operations
      (i) Add number 256 to R1, place the sum in register R2
      (ii) Place a 2's complement of -1 into register R3
      (iii)ANDing , R1 content with the complement of 256,place the result in register R2
      (iv)To returning from subroutine
      (v) Copy a complement of 4 into R1
5. a)Compare ARM and Thumb instruction
   b) Write an ALP to find factorial of a number
6. a)Explain ARM Processor exceptions and modes along with a block diagram.
   b) Justify why the link register must be adjusted before returning from the exception.
7. a) Explain the importance of brown out detector.
   b) Sketch memory map of LPC2148
8. a)Write Embedded C statements to configure (3)
   i. Pin 19 of Port 0 as Output and want to drive it High(Logic 1)
   ii. Making output configured Pin 15 High of Port 0 and then Low
   iii. Configuring P0.13 and P0.19 as Output and Setting them High:
   b) Interface LED to P0.0 Write C program to LED Dimming using PWM (7)
9. Explain the architecture of TIMER module
10. a)List any 5 features of ADC.

Model Question Bank

Course Title : **ARM Controller**	Course Code: **15EC52T**

Unit -1: ARM Embedded System and Arm Processor Fundamentals

5Marks

Remember

1. List advantages & drawbacks of RISC
2. List the features of ARM instructions suitable for embedded applications.
3. List the special features of ARM processor design.
4. Define pipelining & high code density.
5. Define processor modes. List all different processor modes.
6. Define banked registers. Explain
7. Describe the functions of flags of CPSR register.
8. Describe the functions of IFT bits of CPSR register.

Understand

1. Explain AMBA bus protocol.
2. Explain the active registers used in user mode.
3. Explain 3-stage pipe line.
4. Explain processor modes.
5. Explain the role of software components in an embedded system

Application

1. List the applications of ARM processor.
2. Sketch a neat ARM core data flow model.
3. Write the advantages & disadvantages of pipelining.
4. Discuss the process of filling the pipeline with a neat sketch.

Analyse

1. justify how ARM is suited to perform DSP type function
2. justify how ARM is suitable for mobile applications
3. justify the features that improves code density

10 Marks

Understand

1. a) Explain AMBA bus protocol. (7)
   b) Discuss mode bits of CPSR register.(3)
2. a) Explain the two architectural levels of Bus. (3)
   b) Explain 3-stage pipelining of ARM-7 with example. (7)
3. a) Explain register file of ARM processor with a neat sketch. (7)
   b) Explain the function of special function registers of ARM. (3)
4. a) Explain different processor modes. (7)
   b) Explain the AMBA bus variants. (3)
5. Explain banked registers with a neat diagram.
6. Explain the bit structure of CPSR.
7. Explain ARM core data flow model.
8. Explain the block diagram of ARM based embedded device.

Unit-2: ARM Instruction Set

5Marks

Understanding

1. Explain conditional execution with an example.
2. Explain MAC unit with an example.
3. Explain Barrel shifter with a neat sketch.
4. Explain 5 different shift operations that can be used with Barrel shifter.
5. List compare instructions & Write the useful of AND, ORR, EOR instructions
6. Describe the difference between ADR & ADRL

Application

1. List the data processing instructions with one example each.
2. Explain stack operation using STM & LDM instructions.
3. Explain SWAP & SWI instructions with example
4. Explain AND & EOR instructions with example
5. Explain TST & TEQ instructions with example
6. Write a note on software interrupt instruction.

Analyse

1. Predict the operation performed by the execution of each compare instruction
2. Calculate the effective address of the following instructions if register R3=0x4000 and register R4=0x20
   (i) STRH R9,[R3,R4]
   (ii) LDRB R8,[R3,R4,LSL #3]
   (iii)LDR R7,[R3],R4
   (iv)STRB R6,[R3],R4,ASR #2
   (v) LDR R0,[R3,-R4,LSL #3]

Evaluate

1. Distinguish between post & pre indexed addressing mode with an example

Create

1. Test whether the following instruction are pre or post indexed addressing mode
   (i) STR R6,[R4,#4]
   (ii) LDR R3,[R12],#6
   (iii)LDRB R4,[R3,R2]
   (iv)LDR R6,[R0,R1,ROR #6]
   (v) STR R3,[R0,R5,LSL #3]
2. Write the instruction to perform the following operations
   (i) Add number 256 to R1, place the sum in register R2
   (ii) Place a 2's complement of -1 into register R3
   (iii)ANDing , R1 content with the complement of 256,place the result in register R2
   (iv)To returning from subroutine
   (v) Copy a complement of 4 into R1

Unit-3: Introduction to THUMB and ARM Programming

5Marks

Remember

1. Describe the function of ENTRY, EXPORT, and AREA assembler directives
2. Describe the function of EQU, SPACE,ALIGN assembler directives
3. Describe the function of DCD,DCB,DCW assembler directives

Understand

1. Explain register usage in thumb.
2. Explain ARM- THUMB networking using BLX instruction
3. Explain ARM- THUMB networking using BX instruction

4. Explain the structure of ARM assembly language format

Application

1. Compare ARM & thumb instructions.
2. Write an ALP to add two 64 bit numbers.
3. Write an ALP to find factorial of a number
4. Write an ALP to find length of a null terminated string
5. Write an ALP to multiply two 16 bit numbers
6. Write an ALP to find smallest number in an array
7. Write an ALP to find largest number in an array

Evaluate

1. Justify how code density will be improved using Thumb
2. Justify why interrupt stack at the top of user stack memory

Unit-4:Exception and Interrupt handling schemes

5 Marks

Remember

1. Define exception, interrupt, interrupt vector table
2. Define the terms interrupt latency& list the methods to minimize latency
3. List function of the instructions used in the vector table.
4. List various interrupt handling schemes.

Understand

1. Explain vector table
2. Discus link register offsets
3. Explain exception handling
4. Explain interrupt latency with diagram.
5. Explain interrupt stack design with a neat sketch
6. Explain the action on entering exception
7. Explain the action on leaving the exception

Application

1. Write a note on exception priorities.
2. Write a note on interrupts
3. Write code for enabling IRQ& FIQ interrupts.
4. Write code for disabling IRQ& FIQ interrupts.
5. Distinguish between nested & non-nested interrupt handler.

Analyse

1. Justify why the link register must be adjusted before returning from the exception.
2. Differentiate between interrupts and exceptions

10 Marks

Understand

1. Explain ARM Processor exceptions and modes along with a block diagram.
2. Explain IRQ & FIQ exceptions with example.
3. Explain non-nested interrupt handler with a neat sketch.
4. Explain nested interrupt handler with a neat sketch.

Unit-5: LPC2148 ARM CPU

5 Marks

Remember

1. List any 5 features of LPC2148
2. List any 5 applications LPC2148
3. List any 5 features of SPI
4. List any 5 features of RTC

5. Name any 5 features of UART
6. Name any 5 features of I^2C
7. Name any 5 features of SSP
8. Name any 5 system control units of LPC2148

Understand

1. Explain the importance of brown out detector.
2. Discus reset & wakeup timer
3. Explain power modes

Application

1. Sketch the diagram of LPC2148
2. Sketch memory map of LPC2148
3. Write a note on APB bus

Unit-6: LPC 2148 – Peripherals

5 Marks

Remember

1. List any 5 features of GPIO
2. List the applications of GPIO
3. List any 5 features of Timer in LPC2148
4. List any 5 features of PWM
5. List any 5 features of ADC
6. List the functional features of DAC
7. List the different PLL registers & explain each bit function of PLLCON register
8. Define timer, PLL, PWM, SPI, RTC
9. List Rules for single &double edge controlled PWM outputs
10. Name the applications of timer

Understand

1. Explain pin connect block of LPC2148
2. Explain legacy GPIO registers
3. Explain enhanced featured GPIO registers
4. Explain the operation of PLL in LPC2148
5. Explain the bit structure of PLLCFG register
6. Explain the bit structure of PLLSTAT register
7. Describe bit structure of DACR register

Application

11. Sketch a neat block diagram of PLL.
12. Write the procedure for PLL frequency calculation
13. Sketch a neat block diagram of TIMER
14. Write Embedded C statements to configure
    iv. Pin 19 of Port 0 as Output and want to drive it High(Logic 1)
    v. Making output configured Pin 15 High of Port 0 and then Low
    vi. Configuring P0.13 and P0.19 as Output and Setting them High:
    vii. Configuring 1st 16 Pins of Port 0 (P0.0 to P0.15) as Output and Setting them High
15. Write C program to interface LEDs to all pins in port 0 (P0.0 to P0.15) make repeatedly blink all LEDs High then Low then High and so on (introduce some delay).
16. Interface switch to P0.7 pin and LED to P0.30 write C program to GLOW LED when switch is Pressed

Evaluate

1. Choosing, FOSC = 10MHz and CCLK = 60MHz configure PLL0
2. Choosing, FOSC = 12MHz and requires the USB clock of 48MHz configure PLL1
3. Calculate values of PLL Configuration Register (PLLCFG) for the following frequency specifications cclk =60MHz, pclk=15MHz. Fcco is 156 MHz to 320 MHz.

10 Marks

Understand

17. Explain registers used in pin connect block of LPC2148
18. Explain the operation of PLL in LPC2148 with a neat diagram
19. Explain the architecture of TIMER module
20. a) Describe bit structure of DACR register (5)
    b) Explain each bit function of PLLCON register (5)

Application

1. a)Sketch a neat block diagram of PLL.(5)
   b) Write the procedure for PLL frequency calculation (5)
2. Write C code to set up, initialize and connect PLL0 to get CCLK & PCLK @ 60Mhz when input clock from Crystal is 12Mhz
3. Write c program to interface LEDs to Port0, which flashes a LED every half second using timer.
4. Write C program to generate sine wave using PWM
5. Interface LED to P0.0 Write C program to LED Dimming using PWM
6. Write C program to Interfacing temperature sensor with LPC2148, read temperature from temperature sensor and it display into PC through serial port.
7. Generate ramp waveform from LPC2148 microcontroller using DAC.

End

Government of Karnataka
Department of Technical Education
Board of Technical Examinations, Bengaluru

Course Title **: Advanced Communication**	Course Code: **15EC53T**
Semester :**5**	Course Group: **Core**
Teaching Scheme in Hrs (L:T:P) : **4:0:0**	Credits : **4**
Type of course: **Lecture + activity**	Total Contact Hours: **52**
CIE : **25 Marks**	SEE : **100 Marks**

Prerequisites

Knowledge of analog and digital communication, and basics semiconductor devices**.**

Course Objectives

1. To learn Microwave and Radar systems.
2. To study Satellite basics and Satellite communication systems.
3. To understand the concepts of mobile communication and other wireless technologies.

Course Outcomes

On completion of the course, students will be able to-

1. Appreciate the importance of microwave signal and learn important microwave devices.
2. Describe the working principle of different RADAR systems and their applications.
3. Understand the Satellite fundamentals and types of satellite.
4. Explain the working of a Satellite communication system and its other subsystems.
5. Know the applications of Satellites in different areas.
6. Explain the working principle of Mobile communication and GSM Services.

Course Outcome		CL	Linked PO	Teaching Hrs
CO1	Appreciate the importance of microwave signal and learn important microwave devices.	***R/U/A***	1,2,3,6,10	09
CO2	Describe the working principle of different RADAR systems and their applications.	***R/U/A /E***	1,2,3,4,10	10
CO3	Understand the satellite fundamentals and types of satellite.	***R/U/A***	1,2,3,10	08
CO4	Explain the working of a Satellite communication system and its other subsystems.	***R/U/A***	1,2,3,4,5,10	07
CO5	Know the applications of satellites in different areas.	***R/U/A***	1,2,5,6,9,10	06
CO6	Explain the working principle of Mobile communication and GSM Services	***R/U/A /C***	1,2,3,4,9,10	12
			Total sessions	**52**

Legends: PO-Program Outcome, CO-Course Outcome, CL-Cognitive Level, R-Remember, U-Understand, A-Apply, E-Evaluate, C-Create

Mapping Course Outcomes with Program Outcomes

Course Outcomes	Programme Outcomes									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	*	*	*	--	--	*	--	--	--	*
CO2	*	*	*	*	--	--	--	--	--	*
CO3	*	*	*	--	--	--	--	--	--	*
CO4	*	*	*	*	*	--	--	--	--	*
CO5	*	*	--	--	*	*	--	--	*	*
CO6	*	*	*	*	--	--	--	--	*	*

***Legend**: * Linked, -- No link*

Course-PO Attainment Matrix

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
Advanced Communication	**3**	**3**	**3**	**1**	**1**	**1**	**--**	**--**	**1**	**3**

***Legend**: Addressing levels: 1-Slight, 2-Moderate, 3-Substantial, -- Not addressed*

***Quantification Method:** This is to relate the level of PO with the number of hours devoted to the COs which address the given PO. If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3; if 25 to 40% , Level 2; if 5 to 25%, Level 1; and if < 5%, not addressed.*

Course content and pattern of marks for SEE

Unit No	Unit Name	Hour	Questions to be set For SEE					Marks Weightage	Weightage (%)
			R	U	A	E	C		
1	Microwave and Devices	09	05	10	10	00	00	25	17.24
2	Radar Principles and Applications	10	05	10	10	05	00	30	20.69
3	Satellite Fundamentals	08	05	05	05	00	00	15	10.34
4	Satellite communication System	07	05	05	05	00	00	15	10.34
5	Satellite Applications	06	05	05	10	00	00	20	13.80
6	Mobile and Wireless Communications	12	05	15	15	00	05	40	27.59
	Total	**52**	**30**	**50**	**55**	**05**	**05**	**145**	**100**

Course Content

Unit 1: Microwave Devices **Duration:09Hrs**

Microwave signal: Definition, frequency bands, advantages and applications. Waveguides: Need and Types, Energy coupling methods: Probe, Loop and Aperture coupling. Definition of TE and TM modes. Dominant mode for rectangular and circular waveguides.

Microwave semiconductor devices – Construction and applications of: IMPATT and TRAPATT. Microwave tube devices- Construction, Working, Performance and Applications:Two cavity Klystron, Reflex klystron, Magnetron and Travelling Wave Tube (TWT).

Unit 2: Radar Principles and Applications **Duration:10Hrs**

Radar: Introduction and applications. Definitions: PRF, PRI, Average power, peak power and duty cycle. Radar range equation and factors influencing the radar range. Pulsed radar system- Principle and Block diagram. Modulator - Line type. Duplexer - Branch type. Displays: A-scope and PPI.

Antenna Scanning: Horizontal, Vertical, Nodding and Spiral. Tracking: Sequential lobing, conical scan and Monopulse. Special purpose radars- MTI Radar, CW Doppler radar, FM-CW Radar.Radar beacons, Aircraft landing system: GCA and ILS.

Unit 3: Satellite Fundamentals **Duration:08Hrs**

Definition of Satellite, Satellite orbits, Kepler's Laws (only statements), Apogee and Perigee, Azimuth and Elevation angles, Subsatellite point, subsatellite path, Ascending and descending nodes, Posigrade and Retrograde orbits, Uplink and Downlink, Orbital period and radius of Geosynchronous satellite, Satellite Eclipse, Polar and Geostationary satellites-Advantages and Disadvantages. LEO, MEO & GEO satellites.Station keeping, attitude control and Thermal control.

Unit 4: Satellite Communication System **Duration:07Hrs**

Satellite communication system- Block diagram, Transponder- Single conversion, double conversion, regenerative transponder. Satellite frequency allocation and satellite bandwidth. Increasing channel capacity- frequency reuse and spatial isolation. General block diagram of communication satellite, Satellite subsystems- Classification, Power subsystem, TT&C subsystem. Applications payload. Earth station- block diagram.

Unit 5: Satellite Applications **Duration:06Hrs**

Global Positioning System(GPS). Satellite for Television applications: Direct-To-Home (DTH) and Cable TV. Voice and Data communication, Earth observation (Remote Sensing) applications, Military applications, Introduction to VSAT.

Unit 6: Mobile and Wireless Communications **Duration:12Hrs**

Mobile communication: Principle of digital telephony. Features of 1G, 2G, 2.5G, 3G, 4G cellular networks, Cellular concept, Frequency reuse, Capacity expansion techniques- Cell splitting and cell sectoring, working of a typical cellular system. GSM services and features, GSM system architecture, CDMA 2000 system-services and features. LTE services and features. Handoff strategies.

Wireless communication: Bluetooth-Components, Stack, Links and channels, Bluetooth networking, Bluetooth connections, Transmissions characteristics, Applications. Features and applications of Wi-Fi , Hot-spot.

ZIGBEE- Stack, Zigbee Addressing- Messaging, Broadcast addressing, Group addressing. Zigbee network topologies, Applications of Zigbee.

References

1. Electronic communication system by George Kennedy and Davis Fourth Edition.
2. Communication Electronics by Frenzil Third Edition, TMH Publications
3. Microwave Engineering, by Vasuki, Helena and Rajeswari, McGrawHill education
4. Satellite communications by Dr. D.C. Agarwal. Seventh edition, Khanna publishers.
5. Introduction to Radar Systems by Skolnic, TMH Publications
6. Wireless communications by Theodore S.Rappaport. II Edition,PHI publications.
7. Communication engineering, S Vijayachitra, McGrawHill Education. ISBN-13: 978-1-25-900686-9
8. Introduction to wireless telecommunications systems and networks by Mullett, CENGAGE Learning
9. Mobile and personal communications system and services by Raj Pandya
10. Satellite communications, by Dennis Roddy, , McGrawHill education
11. Mobile communications by Jochen Schiller.
12. Satellite Communication by Anil K Maini, Wiley India Publications

Suggested List of Student Activities **Duration: 4hrs**

***Note*: The following activities or similar activities for assessing CIE (IA) for 5 marks:**

Sl. No.	Activity
	1. Prepare a report on the limitations of microwave signals for conventional low frequency devices. 2. Prepare a report on Microwave device: Pin diode, Varactor diode and Tunnel diode. 3. Visit the local BSNL office and prepare a report on it. 4. Visit the local Microwave station and prepare a report on it. 5. Prepare a report on different types of antennas used in radar application. 6. Visit the local Radar station and prepare a report on it. 7. Prepare a report on Historical background of Satellite. 8. Prepare a report in Indian satellites. 9. Prepare a report on activities of ISRO. 10. Visit a local Mobile service Centre and prepare a report on it. 11. Prepare a report on cashless transaction. **Execution Mode** 1. Maximum of 3-4 students in each batch should do **any one** of the above activity or similar activity related to the course and before take up, get it approved from concerned Teacher and HOD. ***2.*** Each batch should conduct different activity and no repeating should occur. ***3.*** Submit a brief report on the activity done on 4-6 pages, A4 size handwritten paper. Papers should be simple stapled or tagged. Avoid plastic-based files for submitting of reports.

4. Activities can be carried off-class or in the laboratory, as the case may be.
5. Assessment shall be made based on quality of activity/ presentation/ demonstration and report.

Institutional Activities

Note: One activity to be conducted each month of the semester.

Sl. No.	Activity
1	Organize Seminar, workshop or Lecture from experts on Microwave and Radar engineering field.
2	Organize a workshop from experts on servicing and repairing of Mobile phones.
3	Arrange for student's visit to nearest Microwave/ Mobile station.

Course Delivery

The course will be delivered through lectures, presentations and support of modern tools.

Course Assessment and Evaluation Scheme

Assessment Method	What		To Whom	Assessment mode /Frequency /timing	Max. Marks	Evidence Collected	Course Outcomes
Direct assessment	CIE	IA	Students	Three tests+	20	Blue Books	1 to 6
				Activity*	05	Activity Sheets	1 to 6
	SEE	End exam		End of the course	100	Answer Scripts at BTE	1 to 6
				Total	125		
Indirect assessment	Student feedback on course		Students	Middle of the Course	Nil	Feedback Forms	1 to 3& Delivery of course
	End of course survey			End of the Course	Nil	Question-naires	1 to 6, Effectiveness of delivery instructions & assessment methods

Legends: CIE-Continuous Internal Evaluation, SEE- Semester End-exam Evaluation

+ Every I.A. test shall be conducted for 20 marks. Average of three tests, by rounding off any fractional part thereof to next higher integer, shall be considered for IA.

***S**tudents should do activity as per the list of suggested activities/ similar activities with prior approval of the teacher. Activity process must be initiated well in advance so that it can be completed well before the end of the term and assessed through appropriate Rubrics.

Questions for CIE and SEE will be designed to evaluate the various CLs as per the weightage shown in the following table.

Sl. No.	Cognitive Levels (CL)	Weightage (%)
1	Remembering	20
2	Understanding	35
3	Applying	37
4	Evaluate	04
5	Create	04
	Total	**100**

(i) Model of rubrics for assessing student activity

Dimension	**Scale**					**Marks (Example)**
	1 Unsatisfactory	**2 Developing**	**3 Satisfactory**	**4 Good**	**5 Exemplary**	
1. Research and gathering information	Does not collect information relate to topic	Collects very limited information, some relate to topic	Collects basic information, most refer to the topic	Collects more information, most refer to the topic	Collects a great deals of information, all refer to the topic	3
2. Full-fills team roles and duties	Does not perform any duties assigned to the team role	Performs very little duties	Performs nearly all duties	Performs almost all duties	Performs all duties of assigned team roles	2
3. Shares work equality	Always relies on others to do the work	Rarely does the assigned work, often needs reminding	Usually does the assigned work, rarely needs reminding	Always does the assigned work, rarely needs reminding.	Always does the assigned work, without needing reminding	5
4. Listen to other team mates	Is always talking, never allows anyone to else to speak	Usually does most of the talking, rarely allows others to speak	Listens, but sometimes talk too much,	Listens and talks a little more than needed.	Listens and talks a fare amount	3
					Total marks	ceil(13/4) = 4

(iii) CIE/IA Tests (20 Marks)

Three tests have to be conducted in accordance with the test pattern given below and average marks of them are considered for CIE/IA with specified schedule.

(iv) Format of CIE/IA test question paper

CIE Question Paper					
Institution Name and Code					
Course Co-ordinator/Teacher					
Program Name		***Test No.***		*Units*	
Class/Sem		*Date*		*CL*	
Course Name		*Time*		*COs*	
Course Code		*Max. Marks*		*POs*	
Note to students: Answer all questions					

Question No.	Question	Marks	CL	CO	PO
1					
2					
3					
4					

Legends: PO-Program Outcome, CO-Course outcome, CL-Cognitive Level, R-Remember, U-Understand, A-Apply
Note: Internal choice may be given in each CO at the same cognitive level (CL).

(v) Model question paper for CIE

CIE Question Paper					
Institution Name and Code					
Course Co-ordinator/Teacher					
Program Name	Electronics & Communication	***Test No.***	1	*Units*	1 & 2
Class/Sem	5thSem	*Date*	1/1/2017	*CL*	R/U/A
Course Name	Advanced Communication	*Time*	10-11AM	*COs*	1 & 2
Course Code	15EC53T	*Max. Marks*	20	*POs*	1, 2 & 3
Note to students: Answer all questions					

No.	Question	Marks	CL	CO	PO
1	Explain the need for waveguides in microwave systems. **OR** Explain the construction of a two cavity klystron device.	05	U/A	1	1,2,3,6,10
2	Define Dominant mode. Mention the dominant mode for rectangular and circular waveguides.	05	R	1	1,2,3,6,10
3	Define: PRF, PRI, Average power, Peak power and Duty cycle. **OR** Derive the Radar range equation.	05	R/U/A	2	1,2,3,4,10
4	Sketch and explain the block diagram of CW Doppler Radar.	05	U/A	2	1,2,3,4,10

Semester End-exam Evaluation (SEE)

(i) End-exam question-paper pattern

.Unit No.	Unit Name	Study Duration (Hrs.)	No. Questions for End-exam	
			5 marks Part - a	10 marks Part - b
1	Microwave and Devices	09	1	2
2	Radar Principles and Applications	10	2	2
3	Satellite Fundamentals	08	1	1
4	Satellite communication System	07	1	1
5	Satellite Applications	06	2	1
6I	Mobile and Wireless Communications	12	2	3

	Total	**52**	**09 (45 Marks)**	**10 (100 Marks)**

(ii) Model question paper

Course Title **: Advanced Communication**

Course Code **: 15EC53T** Time **: 3 Hrs**

Semester **: Fifth** Max. Marks**: 100**

Instructions*: 1. Answer any **SIX** question from **Part A** (5x6=30 Marks)*

*2. Answer any **SEVEN** full questions from **Part B** (7x10=70 Marks)*

Part A

1. Define Microwave signals. List the frequency bands
2. Explain the factors that influence radar range.
3. Justify the need for Duplexers in a radar system.
4. State the three Keppler's laws.
5. Explain single conversion transponder with neat figure.
6. List the different applications of satellite technology.
7. Explain DTH television application of satellite.
8. List the Bluetooth components and explain.
9. Write the techniques of capacity expansion in mobile communication.

Part B

1. Explain the construction, working and applications of a Magnetron.
2. Sketch the construction of a TWT and explain its working.
3. Derive the radar range equation.
4. Explain the ILS method of aircraft landing system.
5. Classify and explain the different satellite orbits based on distance from earth.
6. Draw the block diagram of Earth station and explain.
7. Explain the voice and Data communication using satellite..
8. a) Explain the features of 1G and 2G mobile communication system.
   b) Explain GSM architecture with neat sketch.
9. Explain the Cell splitting and cell sectoring methods.
10. Describe Zigbee addressing methods.

Model Question Bank

Course Title : **Advanced Communication**	Course Code: **15EC53T**

UNIT 1. Microwave Devices

05 Marks

Remember

1. Define Waveguide. List the types of Waveguides
2. List the application of Waveguides
3. Define and Sketch the figures of IMPATT & TRAPATT diodes.
4. List the application of Reflex klystron tubes.

Understand

1. Explain the applications of microwave signals.
2. Explain the construction detail of IMPATT diode.
3. Explain the construction detail of TRAPATT diode.
4. Explain the advantages of microwave Signals.

Applying

1. Sketch a neat diagram and explain dominant Mode of Rectangular Waveguide.
2. Sketch a neat diagram and explain dominant Mode of Circular Waveguide.

10-mark Questions

Remember

Understand

1. Explain construction & working of Reflex Klystron.
2. Explain construction & working of TWT.
3. Explain construction & working of Magnetron.
4. Explain construction & working of two cavity klystron.

Applying

1. Explain the construction and working of an IMPATT diode.
2. Explain the construction and working of an TRAPATT diode

Unit 2.Radar Principles and Applications

5 mark

Remember

1. Define PRF and duty cycle.
2. List the factors that affect radar range equation.
3. List the applications of radar.
4. List the antenna scanning and tracking methods.
5. Define Average power and Peak power
6. Explain the advantages and disadvantages of Pulsed radar system.

Understand

1. Explain A-scope display with neat figure.
2. Explain PPI display with neat figure.
3. Explain applications of RADAR.
4. Explain different types of antenna scanning.
5. Explain the factors influencing the RADAR range equation.
6. Explain Monopulse tracking of radar.

Evaluate

1. Compare A-scope and PPI displays
2. Compare Pulsed Radar and CW Doppler radar systems.
3. Compare the different antenna scanning methods.

10 marks

Understand

1. Derive RADAR range equation and list the factors which influence it.
2. Explain different methods of antenna tracking.
3. Explain working of CW Doppler RADAR.
4. Explain the working of FM-CW RADAR.
5. Explain the working of MTI RADAR.
6. Explain instrument landing system (ILS).
7. Explain branch type duplexer.
8. Explain the importance of Radar beacons.

Applying

1. Write a note on Pulsed radar system and its uses.
2. Illustrate the working of GCA landing system for aircrafts.
3. Write short notes on radar displays.
4. Sketch the block diagram of CW Doppler radar and explain its working.
5. Sketch the block diagram of FM-CW radar and explain its working.
6. Sketch the block diagram of MTI radar and explain its working.

Unit 3. Satellite fundamentals

5mark

Remember

1. Define satellite. Distinguish between passive and active satellite.
2. Define angle of azimuth and angle of elevation.
3. Define station keeping and attitude control.
4. Define LEO, MEO and GEO
5. List the advantages and disadvantages of LEO.
6. List the advantages and disadvantages of MEO.
7. List the advantages and disadvantages of GEO.
8. Define Posigrade and Retrograde orbits.
9. Define subsatellite point and subsatellite path.

Understand

1. Explain Apogee and Perigee heights with a neat sketch.
2. Explain Ascending and Descending nodes of a satellite orbit.
3. Explain Thermal control of a satellite.

Applying

1. Illustrate the block diagram of a satellite communication system with neat figure.
2. Explain the satellite orbits with neat sketch.
3. With neat figure, explain Uplink and downlink frequencies.

10 marks

Understand

1. Explain polar satellite. List their merits and demerits
2. Explain geostationary satellite. List their merits and demerits.
3. Explain LEO, GEO and MEO satellite.

Applying

1. Compare LEO, GEO and MEO satellite.
2. Derive the expression for finding the orbital period and radius of a geosynchronous satellite.
3. Sketch and explain the different orbits of a satellite based on inclination.

Unit 4. Satellite communication system

5 marks

Remember

1. Define Satellite frequency allocation and bandwidth.
2. Define Transponders and List the types of satellite transponders.
3. List the different types of satellite subsystems.

Understand

1. Explain Single conversion transponder with neat sketch.
2. Explain double conversion transponder with neat sketch.
3. Explain Regenerative transponder with neat sketch.
4. Explain Power subsystem of a satellite.
5. Explain TT&C subsystem of a satellite.
6. Explain applications payload of a satellite.

Applying

1. Illustrate the importance of a transponder in a satellite system.
2. Explain methods of increasing channel capacity of a satellite.
3. Explain Frequency and spatial isolation techniques for increasing the satellite channel capacity.
4. Describe the general block diagram of a communication satellite.

10 marks

Understand

1. Explain the working of TTC satellite subsystem with neat block diagram.
2. Explain working of a satellite earth station with block diagram.
3. Describe transponder. Explain working of regenerative transponder with neat sketch.

Unit 5. Satellite application:

5 marks

Remember

1. List satellite applications in different areas.
2. List the remote sensing applications of satellite.
3. List the components and applications of GPS.
4. Define VSAT concept.

Understand

1. Explain GPS.
2. Explain VSAT.
3. Explain earth observation application of satellite.
4. Describe cable TV application of satellite

10 marks

Applying

1. Explain DTH system with neat figure.
2. Explain GPS system with neat sketch.
3. Illustrate voice and data communication through satellite.
4. Explain satellite TV applications.

Unit 6.Mobile and Wireless communications.

5marks

Remember

1. Define mobile communication and list the generations of mobile communication.
2. List the features of CDMA 2000 system.
3. List the components of Bluetooth.
4. List the application and features of Wi-Fi.
5. List the application and features of Hot-spot..
6. Define Zigbee and list its addressing types.
7. List the Zigbee network topologies.

Understand

1. Explain 1G and 2G mobile systems.
2. Explain GSM services.
3. Explain the features of GSM.
4. Explain Handoff strategies.
5. Explain Bluetooth operation.
6. Explain Zigbee network topologies.

Applying

1. Sketch the GSM system architecture.
2. Sketch the Bluetooth stack organisation explain it
3. Explain applications of Zigbee.
4. Illustrate the cell splitting and cell sectoring.

Create

1. Write the concept of cellular network.
2. Write the importance of frequency reuse in mobile communication.
3. Write the importance of cell splitting and cell sectoring in mobile networks.

10 marks

Understand

1. Explain the operation of GSM architecture with neat sketch.
2. Explain GSM services and features.
3. Explain Bluetooth components and its links & channels.
4. Explain the transmission characteristics and applications of Bluetooth.
5. Explain the network topologies and applications of Zigbee.

Applying

1. Illustrate the various generations of mobile communication.
2. Write a note on GSM services and features.
3. Explain the working of a typical cellular system.
4. Explain the features of Wi-Fi and Hot-Spot technologies.
5. Explain the Zigbee addressing methods.

End

Government of Karnataka
Department of Technical Education
Board of Technical Examinations, Bengaluru

Course Title **: Applications of Electronics Engineering**	Course Code: **15EC54T**
Semester : **5**	Course Group: **Core**
Teaching Scheme in Hrs (L:T:P) : **4:0:0**	Credits : **4**
Type of course: **Lecture + activity**	Total Contact Hours: **52**
CIE : **25 Marks**	SEE : **100 Marks**

Prerequisites

Basics concepts of electronics, communications and computers.

Course Objectives

1. Know penetration of electronics applications in various fields of society.
2. Appreciate influence of electronics in entertainment, consumer, automobile and robotic applications
3. Select an application/area for professional career

Course Outcomes

On completion of the course, students will be able to:

Course Outcome		CL	Linked PO	Teaching Hrs
CO1	Understand the role of electronics in consumer applications	**R/U/A**	2	8
CO2	Understand the importance of electronics in automobile applications	**R/U/A**	3	10
CO3	Understand various electronic audio systems	**R/U/A**	2	6
CO4	Understand various electronic video systems	**R/U/A**	2	8
CO5	Identify the electronic equipments for entrainment applications	**R/U/A**	4	8
CO6	Understand the basics and working of different elements of robotics	**R/U/A /C**	2	12
	Total sessions including 6 hrs student activity			**52**

Legends: PO-Program Outcome, CO-Course Outcome, CL-Cognitive Level, R-Remember, U-Understand, A-Apply, A-Analyze, C-Create

Mapping Course Outcomes with Program Outcomes

Course Outcomes	Programme Outcomes									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	*	*	--	--	*	*	*	--	*	*
CO2	*	*	*	*	--	--	--	--	*	*
CO3	*	*	*	--	--	--	--	--	*	*
CO4	*	*	*	--	--	--	--	--	*	*
CO5	*	*	*	*	--	--	--	--	*	*
CO6	*	*	*	*	*	--	*	--	*	*

***Legend**: * Linked, -- No link*

Course-Po Attainment Matrix

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
Applications of Electronics Engineering	**-**	**3**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**

***Legend**: Addressing levels: 1-Slight, 2-Moderate, 3-Substantial, -- Not addressed*

***Quantification Method:** This is to relate the level of PO with the number of hours devoted to the COs which address the given PO. If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3; if 25 to 40% , Level 2; if 5 to 25%, Level 1; and if < 5%, not addressed.*

Course content and pattern of marks for SEE

Unit No	Unit Name	Hour	Questions to be set For SEE					Marks Weightage	Weightage (%)
			R	U	A	E	An		
1	Consumer electronics	10	05	10	10			25	19
2	Automobile electronics	10	05	10	10			25	19
3	Audio systems	6	05	5	10			20	12
4	Video systems	6	05	5	10			20	12
5	Entertainment electronics	8	05	05	10			20	15
6	Robotics	12	05	10	20			35	23
	Total	**52**	**30**	**45**	**70**			**145**	**100**

Legend: R- Remember, U-Understand A-Application E-Evaluation, An-Analyse

Course Content

Unit-1: Consumer electronics Duration: 8hrs

Calculator – Structure of a calculator, internal organisation of a calculator.

Microwave oven- Principle of microwave cooking, Block diagram, Types.

Washing machine- Electronic controller of washing machines, Concept of Fuzzy logic and its application in washing machine.

Air conditioners- Air conditioning, Remote controlled air conditioner. Comparison of Barcodes and QR codes.

Refrigeration-Role of electronics.

Office automations: Features of copiers, scanners and printers.

Unit-2: Automobile electronics Duration: 10hrs

Need of Electronics in Automobiles, Electronic ignition, electronic ignition lock system, Anti brake system (ABS), Electronically controlled suspension, Instrument panel displays, Ultrasonic car safety belt system, vehicle proximity detection system, Air-bag system, Vehicle navigation, theft detection and remote locking, solar automobiles.

Unit-3: Audio systems Duration: 6hrs

Terminology in audio systems: Audio signal**,** amplifier, bass control, treble control and decibel.

Microphone- Principle of operation, types and features of microphones.

Headphones- Principle of operation, types and features of Headphones.

Loudspeakers- Features of Basic loud speaker, Crystal loudspeaker and woofers.

Unit-4: Video systems **Duration: 8hrs**

Features of Digital camera, Cam coder and TV camera. Color Television- Terminology and block diagram of TV communication system. Features of TV Transmitter and receiver. Features of video/TV Displays– CRT, PLASMA, LCD, LED, HDTV and Touch screens. Features of Smart-TV.

Unit-5: Entertainment electronics **Duration: 8hrs**

Concept of Interactive video system. Features of video gaming systems. Features of LCD projectors and 3D glasses. Concept of Virtual reality and its applications. Identification of electronic instruments for musical applications. Concept of Electronic music synthesizers and their applications**.** Concept of music & video editing and mixing.

Unit-6: Robotics **Duration: 12hrs**

Robot- Definition, Advantages and disadvantages, Functions and Applications.
Control system- Definition, classification – Open-loop and closed-loop systems, Automatic control system.
Components of Robotic system - Manipulator arm, end-effectors (gripper), Actuators and transmissions, Controller, Sensors, Basic motions / degrees of freedom.
Robot Classification–Based on generation, power-type and applications.
Robot qualities- Tactile sensing, Vision and Mobility.
Robot Control systems- Non- servo control and Servo control.
Robotic sensor classification: Internal-state sensors and External-state sensors, tactile and non-tactile sensors.
Robotic vision system- Functions, components of vision system.
Actuators- Definition and features of Electrical actuators, Switching devices (Mechanical and solid state), Drive systems (D.C motors, A.C motors and stepper motors).

References

1. S P Bali, “Consumer Electronics”, Pearson Publishers
2. Tom Denton, “Automobile Electrical and Electronic Systems”. 3rd edition.
3. William. B. Ribbens, “Understanding Automotive electronics”
4. R.K. Rajput, “Robotics and Industrial automation”, S . Chand & Co
5. Web resources (dynamic)
   a) http://ocw.mit.edu/courses/mechanical-engineering/2-12-introduction-to-robotics-fall-2005/lecture-notes/chapter3.pdf
   b) https://www.engineeringforchange.org/uploads/activity/147/147/396/1316201555863/low_cost_projector.pdf

Suggested Student Activities **Duration: 4hrs**

***Note*: The following activities or similar activities for assessing CIE (IA) for 5 marks (Any one) Refer CIE pattern**

Institutional Activities

Sl. No.	Activity
1	Organize Seminar, workshop or Lecture from experts on the modern trends in Robotics and Usage of electronic devices in industries.
2	Organize workshop to develop and demonstrate an electronic application.
3	Organize a hands-on workshop to develop a mini project.

Course Delivery

The course will be delivered through lectures, presentations and support of modern tools. Usage of specific animated videos or demonstration videos from YouTube link is preferable.

Course Assessment and Evaluation Scheme

Assessment Method	What		To Whom	Assessment mode /Frequency /timing	Max. Marks	Evidence Collected	Course Outcomes
Direct assessment	CIE	IA	Students	Three tests+	20	Blue Books	1 to 6
				Activity*	05	Activity Sheets	1 to 6
	SEE	End exam		End of the course	100	Answer Scripts at BTE	1 to 6
				Total	125		
Indirect assessment	Student feedback on course		Students	Middle of the Course	Nil	Feedback Forms	1 to 3 & Delivery of course
	End of course survey			End of the Course	Nil	Question-naires	1 to 6, Effectiveness of delivery instructions & assessment methods

Legends: CIE-Continuous Internal Evaluation, SEE- Semester End-exam Evaluation

+ Every I.A. test shall be conducted for 20 marks. Average of three tests, by rounding off any fractional part thereof to next higher integer, shall be considered for IA.

***S**tudents should do activity as per the list of suggested activities/ similar activities with prior approval of the teacher. Activity process must be initiated well in advance so that it can be completed well before the end of the term and assessed through appropriate Rubrics.

Questions for CIE and SEE will be designed to evaluate the various CLs as per the weightage shown in the following table.

Sl. No.	Cognitive Levels (CL)	Weightage (%)
1	Remembering	20
2	Understanding	30
3	Applying	40
4	Evaluate	06
5	Create	04
	Total	**100**

Continuous Internal Evaluation (CIE) pattern

(i) Student Activity (5 marks)

The following student activities or similar activities can be assigned for assessing CIE (IA) marks

Activity
1. Prepare a report on role of electronics in Aeronautics. 2. Prepare a report on Internet of Things (IOT) (smart automobile, smart home, smart city, Smart Villages, Smart hospitals) 3. Prepare a report on role of electronics in Agriculture 4. Identify at least any ten electronics applications which are not covered in this course and list their features. 5. Prepare a report of features and functioning of electronics voting machine 6. Identify at least any ten electronics applications which are not covered in this course and list their features **Execution Mode** 1. Maximum of 4 students in each batch for student activity. 2. All the above activities need to be distributed evenly to the students based on their interest. 3. For each batch, assign any one activity among 1 to 5; activity 6 is compulsory for all batches. 4. Write qualitative report of 4 to 6 pages; one report per batch. 5. Activities can be carried out off-class. 6. Teacher is expected to observe and record the progress of students' activities; Assessment shall be made based on the following rubrics table

(ii) Model of rubrics for assessing student activity

Dimension	Scale					Marks (Example)
	1 Unsatisfactory	2 Developing	3 Satisfactory	4 Good	5 Exemplary	
1. Information search and documentation	Does not collect information relate to topic	Collects very limited information, some relate to topic	Collects basic information, most refer to the topic	Collects more information, most refer to the topic	Collects a great deals of information, all refer to the topic	3
2. Full-fills team roles and duties	Does not perform any duties assigned to the team role	Performs very little duties	Performs nearly all duties	Performs almost all duties	Performs all duties of assigned team roles	2
3. Shares work equality	Always relies on others to do the work	Rarely does the assigned work, often needs reminding	Usually does the assigned work, rarely needs reminding	Always does the assigned work, rarely needs reminding.	Always does the assigned work, without needing reminding	5
4. Listening skills	Is always talking, never allows anyone to else to speak	Usually does most of the talking, rarely allows others to speak	Listens, but sometimes talk too much,	Listens and talks a little more than needed.	Listens and talks a fare amount	3
					Total marks	ceil(13/4) = 4

(iii) CIE/IA Tests (20 Marks)

Three tests have to be conducted in accordance with the test pattern given below and average marks of them are considered for CIE/IA with specified schedule.

(iv) Format of CIE/IA test question paper

CIE Question Paper								
Institution Name and Code								
Course Co-ordinator/Teacher								
Program Name			***Test No.***		*Units*			
Class/Sem			*Date*		*CL*			
Course Name			*Time*		*COs*			
Course Code			*Max. Marks*		*POs*			
Note to students: Answer all questions								
Question No.	**Question**			Marks	**CL**	**CO**	**PO**	
1								
2								
3								
4								

Legends: PO-Program Outcome, CO-Course outcome, CL-Cognitive Level, R-Remember, U-Understand, A-Apply

Note: Internal choice may be given in each CO at the same cognitive level (CL).

(v) Model question paper for CIE

CIE Question Paper								
Institution Name and Code								
Course Co-ordinator/Teacher								
Program Name	Electronics & Communication		***Test No.***	1	*Units*	1 & 2		
Class/Sem	5^{th} Sem		*Date*	1/1/2017	*CL*	R/U/A		
Course Name	Applications of Electronics Engineering		*Time*	10-11AM	*COs*	1 & 2		
Course Code	15EC54T		*Max. Marks*	20	*POs*	1, 2 & 3		
Note to students: Answer all questions								
No.	**Question**			Marks	**CL**	**CO**	**PO**	
1	List the applications of latest Xerox machines. OR Write the block diagram of Washing machine.			05	R/A	1		
2	List the different available electronic gadgets with their applications.			05	U	1		
3	Explain anti break system. OR List the needs of electronics in automobile.			05	R/U	2		
4	Analyze the block diagram of vehicle navigation.			05	A	2		

Semester End-exam Evaluation (SEE)

(i) End-exam question-paper pattern

.Unit No.	Unit Name	Study Duration (Hrs.)	No. Questions for End-exam	
			5 marks Part - a	10 marks Part - b
I	Consumer electronics	8	1	2
II	Automobile electronics	10	1	2
III	Audio systems	6	2	1
IV	Video systems	8	2	1
V	Entertainment electronics	8	2	1
VI	Robotics	12	1	3
	Total	**52**	**09 (45 Marks)**	**10 (100 Marks)**

(ii) Model question paper

Course Title **: Applications of Electronics Engineering**

Course Code **: 15EC54T** Time **: 3 Hrs**

Semester **: 5** Max. Marks**: 100**

Instructions*: 1. Answer any **SIX** question from **Part A** (5x6=30 Marks)*

*2. Answer any **SEVEN** full questions from **Part B** (7x10=70 Marks)*

Part A

1. List the applications of latest copier machines.
2. Compare calculator and computer.
3. Explain electronic ignition in automobile engines.
4. List different types of microphones, headphones and loudspeaker.
5. Compare various types of microphones.
6. Write a note on smart TV.
7. Mention at least five electronic musical instruments.
8. Define robotics and list applications of ROBOT.
9. List and briefly explain any one robotic sensor.

Part B

1. a) Evaluate the importance of microwave oven in bulk-cooking system like hotels/bakeries.
   b) Enumerate the consumer electronics applications
2. With block diagram, explain vehicle proximity detection system.
3. Explain the following.
   a. ABS
   b. Remote lock
4. a) Explain the importance of electronics in automobile with example.
   b)
5. Compare touch screen based electronic gadget with smart TV.

6. Compare LED, LCD, HDTV.
7. Compare basic loudspeaker and crystal loud speaker.
8. Explain the technology behind the virtual reality.
9. With relative diagram explain degrees of freedom.
10. Analyse the non-servo control system and servo control system in robotic applications.

Model Question Bank

Course Title : **Applications of Electronics Engineering**	Course Code: **15EC54T**

Unit-1
Consumer electronics

5-marks question

Remember

1. Mention any 10 consumer electronic goods
2. List different microware devices and their applications
3. Write the block diagram of Washing machine
4. Write the block diagram of Air condition system
5. Write the block diagram of Refrigeration
6. List the applications of latest Xerox machines

Understand

1. Explain internal organization of calculator
2. Explain the working principle of microwave device
3. Explain the working principle of washing machine
4. Importance of refrigeration in home and dairy-industry, explain.
5. Explain the working principle of Xerox machine
6. List the applications of bar-coding.

Application

1. With an example explain how calculator works

Analyze

1. Analyze the block diagram of microwave oven with its working principle

Create

1. Prescribe the required electronic component to design a calculator

10-marks question

Remember

1. List the different available electronic gadgets with their applications

Understand

Application

1. Mention and justify an electronic machine which helps to clean the cloths

Analyse

1. Evaluate the importance of microwave oven in bulk-cooking system like hotels/bakeries.

Create

1. Prescribe the required electronic component to design a scientific calculator and explain the importance of each components.

Unit-2
Automobile electronics

5-marks question

Remember

1. List the needs of electronics in automobile
2. Write the block diagram of vehicle proximity detection system and mention its various blocks.

Understand

1. Explain electronic ignition
2. Explain anti break system
3. Explain air bag system in automobile

10-marks question

Remember

1. List different blocks in electronically controlled automobile vehicle and explain.

Understand

1. Explain working principle of ABS system with block diagram
2. Explain the following.
   a. Electronic ignition
   b. ABS
   c. Electronically controlled subsystem
3. Explain the concepts of car safety using electronics

Apply

1. Analyse the block diagram of vehicle navigation
2. Explain the importance of electronics in automobile with example

Unit-3
Audio systems

5-marks question

Remember

1. List different types of microphone, headphone and loud speaker
2. Mention any 5 characteristics of microphone

Understand

1. Explain how basic loud speaker works

10-marks question

Understand

1. With relative diagram explain any two microphone
2. Compare basic loudspeaker and crystal loud speaker

Unit-4
Video systems

5-marks question

Remember

1. List image/video capturing and displaying electronic devices
2. Draw the block diagram of colour TV and mention its block
3. Write a note on smart TV

Understand

1. Explain how digital camera works
2. With neat block diagram explain television
3. Compare LED, LCD,HDTV
4. With an example explain how smart TV works.

10-marks question

Understand

1. With neat block diagram explain working of colour TV
2. Compare touch screen based electronic gadget with smart TV

Unit-5
Entertainment electronics

5-marks question

Remember

1. Mention electronic musical instruments
2. Write a note on electronic guitar
3. Mention the applications of virtual reality

Understand

1. Explain how interactive video system works
2. Explain the working of LCD Projector
3. How electronic guitar works, explain
4. Write a note on electronic wind instrument

10-marks question

Remember

1. Mention and explain different electronic music synthesiser
2. Explain the technology behind the virtual reality

Unit-6
Robotics

5-marks question

Remember

1. Define robot and list its functions
2. List the qualities of robot
3. List different robotic sensors
4. Write a note on robotic vision system
5. Define actuators. List its different parts
6. Define control system and list different robotic operation

Understand

1. Explain the importance of robots in this present word
2. List the advantage and disadvantage of robots
3. List and explain different robotic sensors
4. How actuator works explain the relative diagram

10-marks question

Remember

1. List and explain robotic qualities
2. Explain the components of robotic system

Understand

1. Explain working of
   a. Pick and place robot
   b. Line follower robot
2. Briefly explain robotic vision system and its application in industries
3. With relative diagram explain degrees of freedom

Apply

1. Analyse the working of pick and place robot in industrial application with example.
2. Analyse the non servo control system and servo control system in robotic applications.

Government of Karnataka

Department of Technical Education
Board of Technical Examinations, Bengaluru

Course Title: **ARM Controller Lab**		Course Code	:**15EC55P**
Credits	: **3 Credits**	Semester	: **5**
Teaching Scheme in Hrs (L:T:P)	: **0:2:4**	Course Group	: **Core**
Type of course	: **Tutorial + Practical**	Total Contact Hours	: **78**
CIE	: **25 Marks**	SEE	: **50 Marks**

Prerequisites

Knowledge of microcontroller, programming and hardware design.

Course Objectives

1. To study Assembly language programming ofARM7 Processor using KEIL IDE.
2. Understand the interfacing ofI/O devices to LPC2148.

Course Outcomes

At the end of the course, the students will be able to

1. Understand the Procedure to execute assembly language programs with a simulator by using an IDE (Integrated Development Environment).
2. Develop simple assembly language programs.
3. Solve simple problems using ARM development board and embedded C.
4. Interface external peripheral devices to LPC 2148.

Course Outcome		CL	Linked Experiments	Linked PO	Teaching Hrs
CO1	Understand the Procedure to execute assembly language programs with a simulator by using an IDE (Integrated Development Environment).	***R/U***	Section- A E1(Study)	1,2,3,4,10	6
CO2	Analyze the various assembly language programs and simulation	***R/U/A***	Section- A E2-E8	1,2,3,4,8, 9,10	21
CO3	Understand ARM development board and Procedure to flashing of embedded C programs	***R/U***	Section- B E1(Study)	1,2,3,4,10	06
CO4	Interface various external peripheral devices to LPC 2148.	***R/U/A***	Section- B E2-E11	1,2,3,4,8, 9,10	33
				Two CIE/IA Tests	**06**
				Total sessions including 06hrs student activity	**78**

Legend: E- Experiment, R-Remember, U-Understand, A-Application, CL-Cognitive Level, and PO-Program Outcome

Mapping Course Outcomes with Program Outcomes

Course Outcomes	Programme Outcomes									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	*	*	*	*	--	--	--	--	--	*
CO2	*	*	*	*	--	--	--	*	*	*
CO3	*	*	*	*	--	--	--	--	--	*
CO4	*	*	*	*	--	--	--	*	*	*

Course-PO Attainment Matrix

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
ARM Controller Lab	3	3	3	3	--	--	--	3	3	3

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.
If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not addressed.

Course Contents

Unit – 1: Tutorial and Graded exercises 66 Hours

Sl. No.	SECTION - A	Duration (Hr.)
Note: a)This part to be done with a simulator by using an Integrated Development Environment (IDE). b) These programs to be executed/simulated using assembly language.		
1	(i) Familiarization of IDE and ARM development board usage (ii) Familiarization of program execution.	3
2	Program to compute $6X^2$ -9X+2 for a given X.	3
3	Program to find the square of a number (1 to 10) using look up table.	3
4	Program to find the sum of an array of 16-bit numbers; store the 32-bit result in internal RAM.	3
5	Program to find the length of a null terminated string.	3
6	Program to sort an array of 32-bit numbers(ascending and descending)	6
7	Program to search and store all the negative numbers in an array of 32-bit numbers.	3
8	Program to count the number of ones and zeros in a 32-bit integer.	3
9	Program to convert hexadecimal to ASCII and vice versa.	6

SECTION- B		
a. This part should be executed with the use of ARM7 LPC2148 kit. These programs should be written and executed using embedded 'C' Programming language.		
1	Program to interface relay card	6
2	Program to generate a 50% duty cycle, 1 KHz wave and to use it for exciting a buzzer.	3
3	Program to blink a group of 8 LEDs with a delay.	3
4	Switching interface	3
5	Interface 4-digit seven-segment display to display any four letter word.	3
6	Interface stepper motor and control its speed and direction.	3
7	Interface DC motor.	3
8	Interface 2-line LCD module to output a moving message on it.	3
9	Read analog voltage and display its digital equivalent on array of LED.	6
	Two Internal Assessment Tests	6
	Total	**72**

Unit – 2: Student Activities [CIE- 05 Marks] 06 Hours

Sl. No.	Activity/mini project	Duration (Hr.)
1	Room temperature measurement, illumination control, pressure measurement, or any other activity related to sensor by using ARM.	**6**
2	Any other related activity which develop skills of the students.	
3	Some of the programs are listed below which is just a guideline for selecting the programs. Students can also select any other program with the advice of his teacher. List of sample Programs: 1. Program for 8 bit key inputs interface 2. Using external interrupt, Interface switch and for every depression, count value is incremented and displayed on LED 3. Program for 4X4 matrix key board interface 4. Program for transferring any massage/text from kit to PC Using serial port.	

Execution Mode

1. Every student should perform Project activity independently as assigned by the teacher based on interest of the student. Student can also choose any other similar activity with a prior approval from the concerned teacher.
2. Project activities shall be carried out throughout the semester and present the project report at the end of the semester.
3. Report-size shall be qualitative and not to exceed 6 pages;
4. Each of the activity can be carried out off-class; however, demonstration/presentation

should be done during laboratory sessions.

5. Assessment shall be made based on quality of activity, presentation/demonstration and report.
6. Assessment is made based on quality of work as prescribed by the following rubrics table.

Institutional Activity (No marks)

The following are suggested institutional activities, to be carried out at least one during the semester. The course teacher/coordinator is expected to maintain the relevant record (Containing, Activity name, Resource persons and their details, duration, venue, student feedback, etc) pertaining to Institutional activities

Sl. No.	Activity
1	Organize hands-on practice on design and simulation of H/W interfacing
2	Motivate the student to take case study on different applications on LPC2148.

References

1. LPC 2148 User Manual
2. http://www.ocfreaks.com

Course Delivery

The course will be delivered through two-hour tutorials and four-hour hands-on practice per week. Tutorial shall be imparted before the conduction of the experiment. Student activities are off-class and presentation/report evaluation is during assigned lab sessions.

Course Assessment and Evaluation Scheme

Master Scheme

Assessment Method	What		To Whom	Assessment mode /Frequency /timing	Max. Marks	Evidence Collected	Course Outcomes
Direct assessment	CIE	IA	Students	Two tests+	10	Blue Books	1 to 4
				Record@	10	Record Book	1 to 4
				Activity*	05	Report/Sheets	1 to 4
	SEE	End exam		End of the course	50	Answer Scripts at BTE	1 to 4
				Total	75		
Indirect assessment	Student feedback on course		Students	Middle of the Course	Nil	Feedback Forms	1 to 2 Delivery of course
	End of course survey			End of the Course	Nil	Questionnaires	1 to 4 Effectiveness of delivery instructions & assessment methods

Legends: CIE-Continuous Internal Evaluation, SEE- Semester End-exam Evaluation

+I.A. test shall be conducted as per SEE scheme of valuation. However obtained marks shall be reduced to 10 marks. Average marks of two tests shall be rounded off to the next higher digit.

Rubrics to be devised appropriately by the concerned faculty to assess Student activities.

*Students should do activity as per the list of suggested activities/ similar activities with prior approval of the teacher. Activity process must be initiated well in advance so that it can be completed well before the end of the term.

@Record Writing: Average of marks allotted for each experiment; fractional part of average shall be rounded-off to next higher integer.

Composition of CLs

Sl. No.	Cognitive Levels (CL)	Weightage (%)
1	Remembering	20
2	Understanding	30
3	Applying	50
	Total	**100**

Continuous Internal Evaluation (CIE) pattern

(i) Student Activity (5 marks)

The student activities in Unit-2 or similar activities can be assigned

Execution Notes:

1. Activities are assigned batch-wise (maximum of 4 students per batch); any one activity/project per batch should be assigned by the teacher based on interest of the students. Student can also choose any other similar activity with a prior approval from the concerned teacher.
2. Teacher is expected to observe and record the progress of students' activities
3. Assessment is made in accordance with the following **rubrics** table.

(ii) Model of rubrics for assessing student activity (for every student)

Dimension	Scale					Marks (Example)
	1 Unsatisfactory	2 Developing	3 Satisfactory	4 Good	5 Exemplary	
1. Research and gathering information	Does not collect information relate to topic	Collects very limited information, some relate to topic	Collects basic information, most refer to the topic	Collects more information, most refer to the topic	Collects a great deals of information, all refer to the topic	3
2. Full-fills team roles and duties	Does not perform any duties assigned to the team role	Performs very little duties	Performs nearly all duties	Performs almost all duties	Performs all duties of assigned team roles	2
3. Shares work equality	Always relies on others to do the work	Rarely does the assigned work, often needs reminding	Usually does the assigned work, rarely needs reminding	Always does the assigned work, rarely needs reminding.	Always does the assigned work, without needing reminding	5
4. Listen to other team mates	Is always talking, never allows anyone to else to speak	Usually does most of the talking, rarely allows others to speak	Listens, but sometimes talk too much,	Listens and talks a little more than needed.	Listens and talks a fare amount	3
					Total marks	ceil(13/4)= 4

(iii) CIE/IA Tests (10 Marks)

Two tests have to be conducted in accordance SEE pattern and the marks shall be scaled down to 10. Average of two tests, rounding-off any fractional part to next higher integer, shall be considered for CIE/IA.

(iv) Record Evaluation (10 Marks)

Every experiment shall be assigned marks for a scale of 10 after its conduction based on student's performance and quality of write-up. Average of them, by rounding-off any fractional part to next higher integer, shall be considered for CIE/IA.

Semester End-exam Evaluation (SEE) Scheme

Sl. No.	Scheme	Max. Marks
1	Writing and execution/simulation of any one open-ended ALP	05
2	Writing any one C program from graded exercises	15
3	Flash programming and result	25
4	Viva-voce	05
TOTAL		**50**

Note:
1. Candidate is expected to submit the Lab record for the examination
2. Student shall not be allowed to conduct directly

Laboratory Resource Requirements

Hardware Requirement: For a batch of 20 students

Sl. No.	Equipment	Quantity
1	Computers	20
2	LPC2148 Development Board/Kit	10
3	Dual trace oscilloscope.	05
4	All interfacing modules one per each kit and other related accessories	10
5	Digital multimeter	05

Model Questions for Practice and Semester End Examination

N**ote:** The questions in the question bank are indicative but not exhaustive.

Section - A

1. Write and execute an assembly Program to compute $6X^2$ -9X+2 for a given X.
2. Write and execute an assembly Program to Find the square of a number (1 to 10) using look up table
3. Write and execute an assembly Program to find Sum of an array of 16 bit numbers and to store the 32 bit result in internal RAM
4. Write and execute an assembly Program to Find the length of a null terminated string
5. Write and execute an assembly Program to arrange a series of 32 bit numbers in ascending/descending order.
6. Write and execute an assembly Program to search and store all the negative numbers in an array of 32-bit numbers.
7. Write and execute an assembly Program to count the number of ones and zeros in a 32-bit integer.

Section - B

1. Write embedded ‘C’Program to interface relay card
2. Write embedded ‘C’Program to generate a 50% duty cycle, 1 KHz wave and to use it for exciting a buzzer.
3. Write embedded ‘C’Program to blink a group of 8 LEDs with a delay.
4. Write embedded ‘C’Program to interface Switching interface
5. Write embedded ‘C’Program to Interface 4-digit seven-segment display to display any four letter word.
6. Write embedded ‘C’Program to interface Stepper motor and control its speed.
7. Write embedded ‘C’Program to interface Stepper motor and control its direction.
8. Write embedded ‘C’Program to interface DC motor and control its speed using PWM.
9. Write embedded ‘C’Program to Interface 2-line LCD module to output a moving message on it.
10. Write embedded ‘C’Program to demonstrate single edge PWM.
11. Write embedded ‘C’Program to generate triangular wave using DAC.
12. Write embedded ‘C’Program to generate sine wave using DAC.
13. Write embedded ‘C’Program to Read analog voltage and display its digital equivalent on array of LED.

End

Government of Karnataka

Department of Technical Education
Board of Technical Examinations, Bengaluru

Course Title: **PCB Design and Fabrication Lab**		Course Code	: **15EC56P**
Semester	: **5**	Credits	: **3 Credits**
Teaching Scheme in Hrs (L:T:P)	: **0:2:4**	Course Group	: **Core**
Type of course	: **Tutorial + Practical**	Total Contact Hours	: **78**
CIE	: **25 Marks**	SEE	: **50 Marks**

.

Prerequisite

Knowledge of analog and digital circuits.

Course Objectives

1. Understand the need for PCB Design and steps involved in PCB Design and Fabrication process.
2. Familiarize Schematic and layout design flow using Electronic Design Automation (EDA) Tools.

Course Outcomes

At the end of the course, the students will be able to attain the following COs

Course Outcome		CL	Experiments linked	Linked PO	Teaching Hrs
CO1	Appreciate the necessity and evolution of PCB, types and classes of PCB.	***R/U/A***	Unit-1 Chapter 1	1,2,4,10	03
CO2	Understand the steps involved in schematic, layout, fabrication and assembly process of PCB design.	***R/U/A***	Unit-1 Chapter 2 and practice exercises.	1,2,3,4,10	12
CO3	Understand basic concepts of transmission line, crosstalk and thermal issues	***R/U/A***	Unit-1 Chapter 4	1,2,3,4,5, 10	03
CO4	Design (schematic and layout) PCB for analog circuits, digital circuits and mixed circuits.	***R/U/A /AN/E V/C***	Unit 2: Part A Exercises1 to 11	1,2,3,4,5, 10	45
CO5	Design (schematic and layout) and fabricate PCB for simple circuits.	***R/U/A /AN/E V/C***	Unit 2: Part B, Unit 3	1,2,3,4,5, 10	06
				Two CIE/IA Tests	06
				Project Activity	03
				Total Sessions	**78**

Legend: E- Experiment, R-Remember, U-Understand, A-Application, AN-Analyze ,EV-Evaluate, C-Create, CL-Cognitive Level, PO-Program Outcome

Note: Total sessions include two tests

Mapping Course Outcomes with Program Outcomes

Course Outcomes	Programme Outcomes									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	*	*	*	--	--	--	--	--	--	*
CO2	*	*	*	*	--	--	--	--	--	*
CO3	*	*	*	*	*	--	--	--	--	*
CO4	*	*	*	*	*	--	--	--	--	*
CO5	*	*	*	*	*	--	--	--	--	*

Course-PO Attainment Matrix

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
PCB Design and Fabrication Lab	3	3	3	3	3	--	--	--	--	3

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.
If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

Course Contents

Unit-1: Tutorials and Practice Exercises 12Hours

Tutorial		
Sl. No.	**Topic/Exercises**	**Duration (Hr.)**
1	**Introduction to PCB** • Definition and Need/Relevance of PCB • Background and History of PCB • Types of PCB • Classes of PCB Design • Terminology in PCB Design • Different Electronic design automation (EDA) tools and comparison.	03

2	**PCB Design Process** • PCB Design Flow, Placement and routing • Steps involved in layout design • Artwork generation Methods - manual and CAD • General design factor for digital and analog circuits • Layout and Artwork making for Single-side, double-side and Multi-layer Boards. • Design for manufacturability • Design-specification standards	03
3	**Introduction to PCB Fabrication & Assembly** • Steps involved in fabrication of PCB. • PCB Fabrication techniques-single, double sided and multilayer • Etching: chemical principles and mechanisms • Post operations- stripping, black oxide coating and solder masking • PCB component assembly processes	03
4	**Transmission lines and crosstalk** • **Transmission Line:** Transmission lines and its effects Significance of Transmission line in Board design Types of Transmission lines. • **Crosstalk:** The crosstalk in transmission lines Crosstalk control in PCB design parts, planes, tracks, connectors, terminations Minimization of crosstalk. • **Thermal issues:** Thermal mapping of design	03
	Total Duration (Hr.)	**12**

	Practice Exercises	**09Hrs**
2	**Using any Electronic design automation (EDA) software, Practice following PCB Design steps (Open source EDA Tool KiCad Preferable)** **Example circuit:** Basic RC Circuit • Schematic Design: Familiarization of the Schematic Editor, Schematic creation, Annotation, Netlist generation • Layout Design: Familiarization of Footprint Editor, Mapping of components, Creation of PCB layout Schematic • Create new schematic components • Create new component footprints	

Unit – 2: Graded Exercises 45 Hours

Part-A: Design PCB (schematic and Layout) for following exercises.		
Sl.	**Graded Exercises**	**Duration**

No.		(Hr.)
1	Regulator circuit using 7805.	3
2	Inverting Amplifier or Summing Amplifier using op-amp	3
3	Full-wave Rectifier	3
4	Astable or Monostable multivibrator using IC555	3
5	RC Phase-shift or Wein-bridge Oscillator using transistor.	3
6	Full-Adder using half-adders.	3
7	4 bit binary /MOD N counter using D-Flip flops.	3
8	One open-ended (analog/ digital/mixed circuit) experiments of similar nature and magnitude of the above are to be assigned by the teacher (Student is expected to solve and execute/simulate independently).	3
9-11	Design a 8051 Development board having • **Power section** consisting of IC7805, capacitor, resistor, headers, LED • **Serial communication section** consisting of MAX 232, Capacitors, DB9 connector, Jumper, LEDs • **Reset & Input/ output sections** consisting of89C51 Microcontroller, Electrolytic Capacitor, Resistor, Jumper, Crystal Oscillator, Capacitors Note: For SEE any one section among three shall be considered as one exercise.	9
Part-B: Fabricate single-side PCB for simple network		
Sl. No.	**Graded Exercises**	**Duration (Hr.)**
1	Fabricate single-sided PCB, mount the components and assemble in a cabinet for any one of the circuits mentioned in Part-A of graded exercises.	6
	Two Internal Assessment Tests	6
	Total Duration (Hr.)	**45**

Tools and materials required for PCB fabrication:

1. Open source EDA Tool KiCad.
2. Single-sided copper clad sheet.
3. Diluted Acidic solution for copper etching purpose with plastic tray.
4. Tapes and pads for layout design of different dimensions.
5. Hand drilling/Power drilling machine.
6. Tool kit (tong, hand gloves etc.)

Unit – 3: Project/Student Activities [CIE- 05 Marks]

***Note*:The following activities or similar activities for assessing CIE (IA) for 5 marks (Any one)**

Sl. No.	Activity	Duration (Hrs)

1	Design and fabricate PCB for any one project, mount the components and assemble in a cabinet: Some of the projects are listed below which is just a guideline for selecting the project. Students can also select any other project with the advice of his teacher. List of sample circuit: 1. Touch plate switches – transistorized or 555 based 2. Doorbell/cordless bell 3. Clapping switch and IR switch 4. Blinkers 5. Cell charger, battery charger, mobile charger 6. Fire/smoke/intruder alarm 7. Liquid level controller 8. Counters 9. Audio amplifiers	**03**

Execution Mode

1. Every student should perform Project activity independently as assigned by the teacher based on interest of the student. Student can also choose any other similar activity with a prior approval from the concerned teacher.
2. Project activities shall be carried out throughout the semester and present the project report at the end of the semester.
3. Report-size shall be qualitative and not to exceed 6 pages;
4. Each of the activity can be carried out off-class; however, demonstration/presentation should be done during laboratory sessions.
5. Assessment shall be made based on quality of activity, presentation/demonstration and report.
6. Assessment is made based on quality of work as prescribed by the following rubrics table.

Institutional Activity (No marks)

The following are suggested institutional activities, to be carried out at least one during the semester. The course teacher/coordinator is expected to maintain the relevant record (Containing, Activity name, Resource persons and their details, duration, venue, student feedback, etc) pertaining to Institutional activities

Sl. No.	Activity
1	Organize seminar on free-open source EDA software
2	Conduct quiz on PCB Design fundamentals.

References

1. Printed Circuit Board by RS Khandpur, Tata McGraw Hill Education Pvt Ltd., New Delhi
2. Electronic Product Design Volume-I by S D Mehta, S Chand Publications
3. Open source EDA Tool KiCad Tutorial: http://kicad-pcb.org/help/tutorials/
4. PCB Fabrication user guide page: http://www.wikihow.com/Create-Printed-Circuit-Boards , http://www.siongboon.com/projects/2005-09-07_home_pcb_fabrication/ , http://reprap.org/wiki/MakePCBInstructions#Making_PCBs_yourself

5. PCB Fabrication at home(video): https://www.youtube.com/watch?v=mv7Y0A9YeUc, https://www.youtube.com/watch?v=imQTCW1yWkg

Course Delivery

The idea behind this course delivery is to provide relevant tutorial and hands-on practice concurrently. The course will be normally delivered through two-hour tutorials and four-hour hands-on practice per week; hands-on practice shall include practice exercises and graded exercises. Normally, one-hour tutorial followed by two-hour hands-on practice is recommended in each class. In Unit-1, tutorials and practice may be carried out concurrently. However, graded exercise (Unit-II) can also be covered at appropriate point of tutorials of Unit-1. Activities are carried-out off class.

Course Assessment and Evaluation Scheme

Master Scheme

Assessment Method	What		To Whom	Assessment mode /Frequency /timing	Max. Marks	Evidence Collected	Course Outcomes
Direct assessment	CIE	IA	Students	Two tests+	**10**	Blue Books	1 to 5
				Record@	**10**	Record Book	1 to 5
				Activity*	**05**	Report/Sheets	1 to 5
	SEE	End exam		End of the course	**50**	Answer Scripts at BTE	1 to 5
				Total	**75**		
Indirect assessment	Student feedback on course		Students	Middle of the Course	Nil	Feedback Forms	1 to 2 & Delivery of course
	End of course survey			End of the Course	Nil	Questionnaires	1 to 5, Effectiveness of delivery instructions & assessment methods

Legends: CIE-Continuous Internal Evaluation, SEE- Semester End-exam Evaluation

1. I.A. test shall be conducted as per SEE scheme of valuation. However obtained marks shall be reduced to 10 marks. Average marks of two tests shall be rounded off to the next higher digit.
2. Rubrics to be devised appropriately by the concerned faculty to assess Student activities.

***S**tudents should do activity as per the list of suggested activities/ similar activities with prior approval of the teacher. Activity process must be initiated well in advance so that it can be completed well before the end of the term.

@Record Writing: Average of marks allotted for each experiment; fractional part of average shall be rounded-off to next higher integer.

Composition of CLs

Sl. No.	Cognitive Levels (CL)	Weightage (%)
1	Remembering	10
2	Understanding	20
3	Applying	30
4	Analyze	15
5	Evaluate	15
6	Create	10
	Total	**100**

Continuous Internal Evaluation (CIE) pattern

(i) Student Activity (5 marks): The student activities in Unit-3 or similar activities can be assigned by the teacher

Execution Notes:

1. Each student assigned at least one activity listed in Unit-3 based on interest of the students. Student can also choose any other similar /relevant activity with prior approval from the concerned teacher.
2. Teacher is expected to observe and record the progress of students' activities
3. Assessment is made based on quality of work as prescribed by the following **rubrics** table

(ii) Model of rubrics for assessing student activity (for every student)

Dimension	Scale					Marks (Example)
	1 Unsatisfactory	2 Developing	3 Satisfactory	4 Good	5 Exemplary	
1. Research and gathering information	Does not collect information relate to topic	Collects very limited information, some relate to topic	Collects basic information, most refer to the topic	Collects more information, most refer to the topic	Collects a great deals of information, all refer to the topic	3
2. Full-fills team roles and duties	Does not perform any duties assigned to the team role	Performs very little duties	Performs nearly all duties	Performs almost all duties	Performs all duties of assigned team roles	2
3. Shares work equality	Always relies on others to do the work	Rarely does the assigned work, often needs reminding	Usually does the assigned work, rarely needs reminding	Always does the assigned work, rarely needs reminding.	Always does the assigned work, without needing reminding	5
4. Listen to other team mates	Is always talking, never allows anyone to else to speak	Usually does most of the talking, rarely allows others to speak	Listens, but sometimes talk too much,	Listens and talks a little more than needed.	Listens and talks a fare amount	3
					Total marks	ceil(13/4)= 4

(iii) CIE/IA Tests (10 Marks)

Two tests shall be conducted in accordance with SEE pattern and the marks shall be scaled down to 10. Average of two tests, rounding-off any fractional part thereof to next higher integer, shall be considered for CIE/IA.

(iv) Record Evaluation (10 Marks)

Every experiment shall be given marks, in the scale of 10, after its conduction based on student's performance and quality of write-up. Average of them, by rounding-off any fractional part thereof to next higher integer, shall be considered for CIE/IA.

Semester end-exam evaluation (SEE) Scheme

Sl. No.	Scheme	Max. Marks
1	Short questions onUnit-1 (only write-up)	05
2	Design PCB (schematic and layout) for any given circuit (similar complexity as in graded exercises) Schematic Design-10 Marks Layout Design-15 Marks Fabrication–10 Marks Component mounting & soldering-5Marks	40
5	Viva-voce	05
TOTAL		**50**

Note:

1. Candidate shall submit lab-record for the examination.
2. Student shall be allowed to design even if she/he is unable to write the procedure/steps.
3. Candidate must be given the relevant circuit diagram.

Model Questions for Practice and Semester End Examination

Graded Exercises

Design and Fabricate PCB for the given circuit in the following list. Also, mount and solder the components.

1. Full-wave bridge Rectifier.
2. Astable or mono-stable multivibrator using IC555
3. RC Phase shift Oscillator using transistor
4. BJT Amplifier in Common Emitter Configuration
5. Full Adder using half adder.
6. 4-bit binary or MOD N counter using D Flip-flop or JK flip-flop.
7. 4-bit shift-register using JK Flip-flop in any one of PIPO/SIPO/PISO/SISO modes.
8. 89C51/8051 Development board Serial communication section consist of MAX 232, Capacitors, DB9 connector, Jumper, LEDs
9. PCB for-89C51/8051 Development board Reset & Input/ output sections consist of 89C51 Microcontroller, Electrolytic Capacitor, Resistor, Jumper, Crystal Oscillator, Capacitors
10. Regulated power supply (Only filter and regulation sections).
11. Sinosoidal Oscillator using Op-amp.
12. Sinosoidal Oscillator using BJT.
13. Sinosoidal Oscillator using JFET.
14. Active filter circuit using Op-amp

End

- **Paperback:** 496 pages

- **Publisher:** McGraw Hill Education (16 June 1983)
- **Language:** English
- **ISBN-10:** 0074515497
- **ISBN-13:** 978-0074515495

Printed Circuit Boards

Walter Bosshart

Government of Karnataka

Department of Technical Education

Board of Technical Examinations, Bengaluru

Course Title: **Electronics Servicing Lab**		Course Code	:**15EC57P**
Semester	: **5**	Credits	:**3**
Teaching Scheme in Hr. (L:T:P)	: **0:2:4**	Course Group	: **Core**
Type of course	: **Tutorial + Practical**	Total Contact Hours	: **78**
CIE	: **25 Marks**	SEE	:**50 Marks**

Prerequisites

Basic Knowledge of using a computer, using a multimeter and the basics of digital/analog electronics

Course Objectives

Familiarization of the PC components and generalized troubleshooting procedures for electronics equipments.

Course Outcomes

On successful completion of the course, the students will be able to attain the following COs

Course Outcome		CL	Experiments linked	Linked PO	Teaching Hrs
CO1	Identify the different components of a computer and motherboard	***R/U***	part-A E:1 to 3	1,2,3,4,5, 8,9	12
CO2	Assess the cause of faults in PCs and able to substitute the faulty module	***R/U/ A/E***	part-A E:4 to 6	1 , 2,3,4,5,6, 8,9,10	12
CO3	Disassemble, and Assemble the PC as per the requirements and configure it for optimum performance.	***R/U/ A***	part-A E:7 to 11	2 , 4, 5,6,7,8,9, 10	21
CO4	Analyze the troubleshooting techniques and adopt the same in servicing of electronics equipment	***R/U/ A/E***	part-B E:12 to 17	1, 2,3,4,5,6, 8,9,10	21
				Two IA/CIE Tests	06
				Student activity	06
				Total	**78**

Legends: PO-Program Outcome, CO-Course Outcome, CL-Cognitive Level, R-Remember, U-Understand, A-Apply, An-Analyse, E-Evaluate, C- Create

Mapping Course Outcomes with Program Outcomes

Course Outcomes	**Programme Outcomes**									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10

CO1	*	*	*	*	*	--	--	*	*	--
CO2	*	*	*	*	*	*	--	*	*	*
CO3	--	*	--	*	*	*	*	*	*	*
CO4	*	*	*	*	*	*	--	*	*	*

Course-PO Attainment Matrix

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
Electronic Servicing Lab	3	3	3	3	3	3	1	3	3	3

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3

If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2

If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1

If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

Course Contents

Unit-1: Tutorials and Graded Exercises 72 Hours

Sl. No.	Topic/Exercises	Duration (Hr)
	Part-A: PC Servicing Experiments	
1	Identification of the different external components like spike busters, UPS, modem, printer, headphone, microphone, web camera, joystick, flash drives, external HD of a computer, discussion of their functions and configurations	4
2	Identification of the different parts of motherboard like CPU/processor, Socket CMOS, RAM,BIOS ROM, Memory Slots, Power Connectors, IDE Connectors, SATA Connectors, CMOS Battery, AGP, PCI, PCI express, Chipset, cache, Heat sink, discussion of their functions, types. SMPS	5
3	Study of ROM BIOS and CMOS setup utility	3
4	Rectify the faults in SMPS, Selection of wattage of SMPS. Study of different types of power connectors like molex, mini molex, ATX power connectors, CPU 4+4, power connectors for PCI, SATA, number of lines, colour codes and their corresponding voltages.	6
5	Study of beep codes for servicing a PC	3
6	Study of how a virus affects the PC, the features of a good antivirus program, the method of installing antivirus programs, updating their data bases.	3
7	Disassembling of PC: steps Involved in disassembly, necessary precautions	4

8	Assembling of PC: detailed study of installation of power supply, CPU heat sink, fan assembly, RAM modules, internal drives, adapter cards, power connectors, data cables and front panel connectors	5
9	Installation of windows 7 or windows10 operating system by partitioning the hard disk.	3
10	Installation of Linux OS on the computer as a standalone OS and also as a dual boot system, concept of live CD.	3
11	Discussion of the importance of motherboard disk (CD)-Installation of device drivers, updating of device drivers in both windows and Linux.	6
Part-B: Electronic equipment servicing		
12	Understand the safety precautions to be taken while servicing. List the basic tools (electronic repair tools) required for servicing electronic equipment's and their purpose (uses) Identify the faults in Digital ICs and Troubleshoot using digital IC tester/ Logic Probe	03
13	Develop skill in assembly of components, wiring, revisiting soldering and de-soldering methods. ICs soldering practice.	03
14	Explain the basic steps of electronic equipment service and maintenance. a) Study of basic procedure of service and maintenance b) Circuit tracing techniques c) Concepts of shielding, grounding and power supply considerations in instruments d) Importance of functional diagram and servicing manuals e) Trouble shooting chart	06
15	Study of Regulated DC power supply and measurement of standard voltages at various stages of RPS. Identify and rectify the various faults in the Regulated DC power supply.	03
16	Minor repair practices on Decade Boxes (Rotary switches, connectors, components connectivity etc.,)	03
17	Troubleshoot Digital IC Trainer kits – practice minor repairs	03
	Two Internal Assessment tests(CIE)	06
	Total sessions	**72**

Unit - 2: Student Activities [CIE- 05 Marks] 06 Hours

Sl. No.	Activity	Duration (Hrs)
1	Explore datasheet of at least five electronics components and analog/Digital ICs.	**06**
2	List the steps for CD/DVD burning using any open source software. Burn the CD/DVD with any application software's and verify.	
3	Explore service manuals of different types of computers	

Execution Mode

1. Students should do activity as per the list of suggested activities/similar activities with prior approval of the teacher
2. Each student activities shall be carried out (select any one activities) throughout the semester and present the hand-written report of maximum 5 to 6 pages per batch at the end of the semester.

3. Assessment shall be made based on quality of activity, presentation/demonstration and report.

References

1. Communication engineering lab-I manual, Sri. M. Shanmukha Chary, sindoor graphics, Hyderabad-60
2. http://www.consumerelectronics.com

Course Delivery

The course will be normally delivered through two-hour tutorials and four-hour hands-on practice per week. Normally, one-hour tutorial followed by two-hour hands-on practice is recommended in each class. Tutorial shall be imparted before the conduction of the experiment. However, activities are carried-out off-class and demonstration/presentation can be in lab sessions.

Course Assessment and Evaluation Scheme

Master Scheme

Assessment Method	What		To Whom	Assessment mode /Frequency /timing	Max. Marks	Evidence Collected	Course Outcomes
Direct assessment	CIE	IA	Students	Two tests[+]	10	Blue Books	1 to 4
				Record[@]	10	Record Book	1 to 4
				Activity[*]	05	Report/Sheets	1 to 4
	SEE	End exam		End of the course	50	Answer Scripts at BTE	1 to 4
				Total	75		
Indirect assessment	Student feedback on course		Students	Middle of the Course	Nil	Feedback Forms	1 to 2 Delivery of course
	End of course survey			End of the Course	Nil	Questionnaires	1 to 4 Effectiveness of delivery instructions & assessment methods

Legends: CIE-Continuous Internal Evaluation, SEE- Semester End-exam Evaluation

[+] Every I.A. test shall be conducted as per SEE scheme of valuation. However, scored marks shall be scaled down to 10. Average of two tests, by rounding off any fractional part thereof to next higher integer, shall be considered for CIE/ IA.

***S**tudents should do activity as per the list of suggested activities/ similar activities with prior approval of the teacher. Activity process must be initiated well in advance so that it can be completed well before the end of the term.

[@]Record Writing: average of marks allotted for all experiments shall be considered; fractional part of the average shall be rounded-off to next higher integer.

Composition of CLs

Sl. No.	Cognitive Levels (CL)	Weightage (%)
1	Remembering	20
2	Understanding	30
3	Applying	30
4	Evaluate	20
	Total	**100**

Continuous Internal Evaluation (CIE) pattern

(i) Student Activity (5 marks)

The student activities in Unit-2 or similar activities of can be assigned

Execution Notes:

1. Maximum of 2 students in each batch for student activity.
2. Either one of the student activity or any similar activity is mandatory for every batch.
3. Project activities shall be carried out throughout the semester and present the project report and demonstration at the end of the semester.
4. Report shall be qualitative and not to exceed 6 pages; one report per batch shall be submitted.
5. Each of the activity can be carried out off-class; however, demonstration/presentation should be done during laboratory sessions.
6. Assessment shall be made based on quality of activity in accordance with the following **rubrics** table.

(ii) Model of rubrics for assessing student activity (for every student)

Dimension	**Scale**					**Marks (Example)**
	1 Unsatisfactory	**2 Developing**	**3 Satisfactory**	**4 Good**	**5 Exemplary**	
1. Research and gathering information	Does not collect information relate to topic	Collects very limited information, some relate to topic	Collects basic information, most refer to the topic	Collects more information, most refer to the topic	Collects a great deals of information, all refer to the topic	3
2. Full-fills team roles and duties	Does not perform any duties assigned to the team role	Performs very little duties	Performs nearly all duties	Performs almost all duties	Performs all duties of assigned team roles	2
3. Shares work equality	Always relies on others to do the work	Rarely does the assigned work, often needs reminding	Usually does the assigned work, rarely needs reminding	Always does the assigned work, rarely needs reminding.	Always does the assigned work, without needing reminding	5
4. Listen to other team mates	Is always talking, never allows anyone to else to speak	Usually does most of the talking, rarely allows others to speak	Listens, but sometimes talk too much,	Listens and talks a little more than needed.	Listens and talks a fare amount	3
					Total marks	ceil(13/4)= 4

(iii) CIE/IA Tests (10 Marks)

Two tests shall be conducted in accordance with SEE pattern and the marks shall be scaled down to 10. Average of two tests, rounding-off any fractional part thereof to next higher integer, shall be considered for CIE/IA.

(iv) Record Evaluation (10 Marks)

Every experiment shall be given marks, in the scale of 10, after its conduction based on student's performance and quality of write-up. Average of them, by rounding-off any fractional part thereof to next higher integer, shall be considered for CIE/IA.

Semester End-exam Evaluation (SEE) Scheme

Sl. No.	Scheme		Max. Marks
1	Short question on both part-A and part-B	Only write-up	10
2	one experiment from Part-A	Write-up	05
		Conduction	15
3	one experiment from Part-B	Write-up	05
		Conduction	10
4	Viva-voce		05
TOTAL			**50**

Note:

1. 6-hour experiments shall be trimmed/scaled down appropriately so that the student shall be able to perform in 3-hour exam.
2. Candidate is expected to submit record for the examination.
3. Student shall be allowed to conduct experiment even if she/he is unable to write the procedure/steps/algorithm.

Laboratory Resource Requirements

Hardware Requirements: For a batch of 20 students

Sl. No.	Equipment's	Quantity
1	Complete PC with all input/output components	05
2	SMPS	05
3	Windows 7 OS, drivers and Linux OS CD/DVD	05
4	Soldering set	05
5	Regulated power supply	05
6	Multimeters	05
7	Signal/function generators	05
8	Digital IC tester	05
9	Logic IC probes	20

Model Questions for Practice and Semester End Examination

Note: The questions are indicative but not exhaustive.

1. Identify and explain the different internal and external components of a PC.
2. Identify and explain the different parts of a motherboard.
3. Explain SMPS and measure the voltages at different output points.
4. Identify and explain the different types of power connectors along with their corresponding voltages.
5. Explain how a virus affects the PC. Write the steps on installation of antivirus software and update its database.
6. Install windows 7 operating system by partitioning the hard disk.
7. Install Linux OS on the computer as a standalone OS.
8. Install device drivers and update in windows OS.
9. Install device drivers and update in Linux OS.
10. Explain the basic steps of electronic equipment maintenance.
11. Measure standard voltages at various stages of RPS.
12. Identify the faults in given RPS

End

Government of Karnataka
Department of Technical Education
Board of Technical Examinations, Bengaluru

Course Title : **Project Work-I**		Course Code	: **15EC58P**
Semester	: **5**	Course Group	: **Core**
Teaching Scheme in Hr. (L:T:P)	: **0:1:2**	Credits	: **-**
Type of course	: **Practical**	Total Contact Hours	: **39**
CIE	: **25 Marks**		

Prerequisites

Knowledge of electronics and communication engineering, and programming languages.

Course Objectives

Application of the knowledge/concepts acquired in the lower semesters to create/design/implement project relevant to the field of Electronics and Communication Engineering.

Course Outcomes

At the end of the course, the students will be able to

Course Outcome		CL	Teaching Hrs
CO1	Survey the literature and market (for availability of resources)	***R/U/A/C***	30
CO2	Identify the project and synopsis preparation and presentation	***R/U/A/C***	9
		Total sessions	**39**

Legend: R-Remember, U-Understand, A-Application, E-Evaluate, C-Create, CL-Cognitive Level, and PO-Program Outcome

Mapping Course Outcomes with Program Outcomes

Course Outcomes	Programme Outcomes									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	*	*	*	*	--	--	*	--	*	*
CO2	*	*	*	*	--	--	--	*	--	*

Course-PO Attainment Matrix

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
Project Work-I	**3**	**3**	**3**	**3**	**3**	**--**	**--**	**3**	**1**	**3**

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.
If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

Course Assessment and Evaluation Scheme

Master Scheme

Assessment Method	What		To Whom	Assessment mode /Frequency /timing	Max. Marks	Evidence Collected	Course Outcomes
Direct assessment	CIE	IA	Students	Literature survey	**10**	Synopsis Project Model	1
				Market survey	**10**		2
				Report/presentation	**5**		1 to 2
				Total	**25**		
Indirect assessment	Student feedback on course		Students	Middle of the Course	Nil	Feedback Forms	1 to 3 & Delivery of course
	End of course survey			End of the Course	Nil	Questionnaires	1 to 4, Effectiveness of delivery instructions & assessment methods

Legends: CIE-Continuous Internal Evaluation, SEE- Semester End-exam Evaluation

+ Every I.A. component shall be conducted as per SEE scheme of valuation.

- Project evaluation is based on the following Rubrics table

Composition of CLs

Sl. No.	Cognitive Levels (CL)	Weightage (%)
1	Remembering	10
2	Understanding	10
3	Applying	30
4	Evaluation	20
5	Create	30
	Total	**100**

Continuous Internal Evaluation (CIE) pattern

(i) Model of rubrics for assessing project activity (for every student)

Dimension	Scale					Marks (Example)
	1 Unsatisfactory	2 Developing	3 Satisfactory	4 Good	5 Exemplary	
1. Information search and Collection.	Does not collect information relate to topic	Collects very limited information, some relate to topic	Collects basic information, most refer to the topic	Collects more information, most refer to the topic	Collects a great deals of information, all refer to the topic	3
2. Full-fills team roles and duties	Does not perform any duties assigned to the team role	Performs very little duties	Performs nearly all duties	Performs almost all duties	Performs all duties of assigned team roles	2
3. Shares work equality	Always relies on others to do the work	Rarely does the assigned work, often needs reminding	Usually does the assigned work, rarely needs reminding	Always does the assigned work, rarely needs reminding.	Always does the assigned work, without needing reminding	5
4. Listening Skills	Is always talking, never allows anyone to else to speak	Usually does most of the talking, rarely allows others to speak	Listens, but sometimes talk too much,	Listens and talks a little more than needed.	Listens and talks a fare amount	3
					Total marks	ceil(13/4)= 4

(ii) CIE/IA (10+10 Marks)

Literature and market Surveying

(iii) Synopsis/presentation (5 Marks)

End

Government of Karnataka
Department of Technical Education
Board of Technical Examinations, Bengaluru

Course Title	**: Industrial Automation**	Course Code	: **15EC61T**
Semester	:**6**	Course Group	: **Core**
Teaching Scheme in Hrs (L:T:P)	: **4:0:0**	Credits	: **4**
Type of course	: **Lecture + activity**	Total Contact Hours	: **52**
CIE	: **25 Marks**	SEE	: **100 Marks**

Prerequisites

Basics concepts of semiconductor devices, analog and digital Electronics.

Course Objectives

1. Understand the working principle and applications of different power electronic devices
2. Appreciate need for Industrial electronic circuits in the controlled applications.
3. Develop PLC program and appreciate importance of SCADA in DCS in industrial applications.

Course Outcomes

On completion of the course, students will be able to

1. Understand characteristics, and working principle of different types of Power electronic devices and their applications.
2. Analyse the various Triggering and Commutation methods of Thyristors.
3. Describe the working of Choppers, Inverters and cycloconverter circuits and their applications.
4. Select Thyristors circuits for various industrial/controlled applications.
5. Understand basic concepts of PLC and develop application programs.
6. Identify and interpret the functionality of DCS and various elements of SCADA.

Course Outcome		CL	Linked PO	Teaching Hrs
CO1	Understand the construction, characteristics, and working principle of different types of Power electronic devices and their applications.	***R/U/A***	1,2,5,6,7,10	**10**
CO2	Analyse the various triggering and commutation methods of Thyristor.	***R/U/A /E***	1,2,10	**8**
CO3	Describe the working of Choppers, Inverters and cycloconverter circuits and their applications.	***R/U/A***	1,2,3,10	**10**
CO4	Make use of various applications circuits of thyristors.	***U/A/E***	1,2,3,10	**6**
CO5	Understand basic concepts of PLC and develop its programming and applications.	***R/U/A /C***	1,2,3,4,10	**10**
CO6	Identify and interpret the functionality of DCS and various elements of SCADA	***R/U/A***	1,2,3,4,10	**8**
			Total sessions	**52**

Legends: PO-Program Outcome, CO-Course Outcome, CL-Cognitive Level, R-Remember, U-Understand, A-Apply, E-Evaluate, C-Create

Mapping Course Outcomes with Program Outcomes

Course Outcomes	Programme Outcomes									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	*	*	--	--	*	*	*	--	--	*
CO2	*	*	--	--	--	--	--	--	--	*
CO3	*	*	*	--	--	--	--	--	--	*
CO4	*	*	*	--	--	--	--	--	--	*
CO5	*	*	*	*	--	--	--	--	--	*
CO6	*	*	*	*	--	--	--	--	--	*

***Legend**: * Linked, -- No link*

Course-PO Attainment Matrix

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
Industrial Automation	**3**	**3**	**3**	**2**	**1**	**1**	**1**	**--**	**--**	**3**

***Legend**: Addressing levels: 1-Slight, 2-Moderate, 3-Substantial, -- Not addressed*

***Quantification Method:** This is to relate the level of PO with the number of hours devoted to the COs which address the given PO. If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3; if 25 to 40% , Level 2; if 5 to 25%, Level 1; and if < 5%, not addressed.*

Course content and pattern of marks for SEE

Unit No	Unit Name	Hour	Questions to be set For SEE					Marks Weightage	Weightage (%)
			R	U	A	E	C		
1	Power Electronic Devices	10	05	10	10	05	--	30	20
2	Triggering and commutation of SCR	8	05	05	10	--	--	20	15
3	Choppers, Inverters and Cycloconverters	10	05	10	10	05	--	30	19
4	Applications of Thyristors	6	--	05	15	--	--	20	12
5	Programmable Logic Controllers	10	05	05	10	--	05	25	19

6	DCS and SCADA System	8	05	05	10	--	--	20	15
	Total	**52**	**25**	**40**	**65**	**10**	**05**	**145**	**100**

Legend: R- Remember, U-Understand A-Application,E-Evaluate, C-Create

Course Content

Unit 1: Power Electronic Devices **Duration:10Hrs**

Power Electronics-Introduction, need for power devices, features of Power diode, Power BJT, IGBT and MOSFET. SCR- Symbol, constructional features, two-transistor analogy, V-I Characteristics, specifications and ratings. Compare SCR with DIAC and TRIAC. **Controlled rectifiers-** Single phase half-wave controlled rectifier, single phase full-wave bridge controlled rectifier (only resistive load), importance of freewheeling diode. Discuss feasibility of Germanium Controlled Rectifier controlled applications.

Unit 2: Switching of SCR **Duration:08Hrs**

Triggering- Definition and need, triggering circuits: R-Triggering, RC–triggering, Pulse triggering using UJT relaxation oscillators. **Commutation:** Need, discussion of natural and forced commutation of SCR. Discussion of resonant commutation, auxiliary commutation and complementary commutation. Protection of SCR-Snubber circuit.

Unit 3: Choppers, Inverters and Cycloconverters **Duration:10Hrs**

Chopper-Definition**,** working principle, duty cycle, chopper control schemes, step-up and step-down chopper, chopper classifications - first quadrant, second quadrant, two quadrant and four quadrant choppers and applications. **Inverters-** Definition, working principle and types. Half-bridge inverter, full-bridge inverter, series inverter, variable dc link inverter, voltage source and current source inverters. PWM techniques used in inverters and applications. **Cycloconverters**-definition, classification, working of single phase to single phase midpoint cycloconverter, applications (for resistive load only).

Unit 4: Applications of Thyristors **Duration:06Hrs**

Photo-electric Control of SCR, Light Dimmer circuit using DIAC and TRIAC, Burglar alarm circuit. Need for electronic control of motors, armature voltage control and field control method for speed control of DC shunt motor. Speed control of DC motors using dual converters, speed control of Induction motor.

Unit 5: Programmable Logic Controllers **Duration:10Hrs**

Introduction to PLC**,** block diagram of overall PLC system, PLC scanning. **PLC Programming-**Ladder diagram, programming relation to digital logic gates, Boolean algebra–simple examples, PLC register basics. PLC timer-retentive and delay timer functions. PLC counter-up/down counters with examples. Basic number comparison functions. PID control of continues process with respect to PLC-PID.

Unit 6: DCS and SCADA System **Duration:08Hrs**

Data Control System-Introduction, features, hierarchical architecture, advantages and applications. Introduction to HMI/MMI. SCADA-Introduction, background, definition, features, typical SCADA system. SCADA architecture-first to fourth generation. Introduction to SCADA hardware & software, interfacing PLC with SCADA, applications of SCADA. Comparison of PLC and SCADA.

References

1. Power Electronics - Soumitrakumarmandal, McGrawHill education, ISBN-13:978-93-329-0114-8.

2. Power Electronics - 2nd edition, M D singh, K B Khanchandani, McGrawHill education, ISBN-13:978-0-07-058389-4.
3. Programmable Logic Controllers- 4th edition, Frank D, Petruzella, McGrawHill education, ISBN-13:978-93-5260-212-4.
4. Power Electronics – Joseph Vithayathil, McGrawHill education, ISBN-13:978-0-07-070329-4.
5. Industrial electronics and Contol - S.K.Bhattacharya,S.Chatterjee – TTTI, Chandigarh.
6. Power electronics- P C Sen, Mcgraw-Hill Publishing, New Delhi, ISBN-13: 978-0-07-462400-5
7. Programmable Logic Controllers- John W.Webb and Ronald A Reis (Principle and applications)(Fifth Edition).
8. Power Electronics handbook, 3rd edition-MuhammadH. Rashid- Elsevier, ISBN: 978-0-12-382036-5
9. Industrial Electronics & Control-Biswanath Paul - PHI.
10. Industrial Electronics - Bimbra, 2nd Edition, Khanna Publications.
11. Power Electronics - Essentials and Applications by L Umanad, Wiley India Publications.
12. Overview of Industrial Process Automation - KLS Sharma, Elsevier Publication
13. Programmable Logic Controllers -Programming Methods and Applications, John R. Hackworth and Frederick D. Hackworth, Jr.
14. SCADA-Supervisory Control and Data Acquisition System - Stuart A. Boyer, ISA publication (3rd Edition).
15. Practical SCADA for Industry- David Bailey, Edwin Wright, Newnes, (an imprint of Elsevier), 2003.
16. Distributed Computer Control for Industrial Automation- DobrivojePopovic and Vijay Bhatkar, Marcel Dekker Inc.,1990
17. Practical Distributed Control System for Engineers and Technicians- IDC Technologies.
18. http://minitorn.tlu.ee/~jaagup/kool/java/kursused/15/robootika/elektriopik.pdf
19. https://books.google.co.in/books/about/Power_Electronics.html?id=llbvkc52h5gC
20. http://www.dauniv.ac.in/downloads/Electronic%20Devices/21EDCSCRLesson21.pdf
21. https://www.youtube.com/watch?v=9WBOFsPGKiU
22. https://www.youtube.com/watch?v=EzR-mRhFrtw
23. https://en.wikipedia.org/wiki/PID_controller
24. http://www.ni.com/white-paper/3782/en/
25. https://en.wikipedia.org/wiki/SCADA
26. http://www.edgefxkits.com/blog/scada-system-architecture-types-applications/
27. https://scadahacker.com/library/Documents/ICS_Basics/SCADA%20Basics%20-%20NCS%20TIB%2004-1.pdf
28. https://www.fer.unizg.hr/_download/repository/Practical_SCADA_for_Industry.pdf
29. https://en.wikipedia.org/wiki/Distributed_control_system
30. http://faculty.ksu.edu.sa/Emad.Ali/mylib/Workshop/DCS.pdf
31. http://www.ijecse.org/wp-content/uploads/2012/06/Volume-3Number-3PP-269-277.pdf
32. http://www.mjret.in/V1I1/M19-1-1-4-2014.pdf

Suggested List of Student Activities — Duration: 4hrs

***Note*:The following activities or similar activities for assessing CIE (IA) for 5 marks (Any one)**

Institutional Activities

Sl. No.	Activity
1	Organize Seminar, workshop or Lecture from experts on the modern trends in Industrial Automation.
2	Organize Seminar, workshop or Lecture from experts onPLC, SCADA or DCS.

Course Delivery

The course will be delivered through lectures, presentations and support of modern tools.

Course Assessment and Evaluation Scheme

Assessment Method	What		To Whom	Assessment mode /Frequency /timing	Max. Marks	Evidence Collected	Course Outcomes
Direct assessment	CIE	IA	Students	Three tests+	20	Blue Books	1 to 6
				Activity*	05	Activity Sheets	1 to 6
	SEE	End exam		End of the course	100	Answer Scripts at BTE	1 to 6
				Total	125		
Indirect assessment	Student feedback on course		Students	Middle of the Course	Nil	Feedback Forms	1 to 3& Delivery of course
	End of course survey			End of the Course	Nil	Question-naires	1 to 6, Effectiveness of delivery instructions & assessment methods

Legends: CIE-Continuous Internal Evaluation, SEE- Semester End-exam Evaluation

+ Every I.A. test shall be conducted for 20 marks. Average of three tests, by rounding off any fractional part thereof to next higher integer, shall be considered for IA.

***S**tudents should do activity as per the list of suggested activities/ similar activities with prior approval of the teacher. Activity process must be initiated well in advance so that it can be completed well before the end of the term and assessed through appropriate Rubrics.

Questions for CIE and SEE will be designed to evaluate the various CLs as per the weightage shown in the following table.

Sl. No.	Cognitive Levels (CL)	Weightage (%)
1	Remembering	20
2	Understanding	30
3	Applying	40
4	Evaluate	06
5	Create	04
	Total	**100**

Continuous Internal Evaluation (CIE) pattern

(i) Student Activity (5 marks)

The following student activities or similar activities can be assigned for assessing CIE (IA) marks

Sl. No.	Activity
	1. Collect data sheets for various power electronic devices. 2. Make a hand-written report on industrial applications of PLC with logic diagram and their working. 3. Prepare a report and deliver presentation on SCADA systems. **Execution Mode** 1. Maximum of 4 students in each batch for student activity. 2. All the above activities need to be distributed evenly to the students. 3. Write qualitative report of 4-6 pages; one report per batch. 4. Activities can be carried out off-class or in the laboratory as the case may be. 5. Assessment shall be made based on quality of activity/presentation/demonstration and report.

Dimension	Scale					Marks (Example)
	1 Unsatisfactory	2 Developing	3 Satisfactory	4 Good	5 Exemplary	
1. Information search and documentation	Does not collect information relate to topic	Collects very limited information, some relate to topic	Collects basic information, most refer to the topic	Collects more information, most refer to the topic	Collects a great deals of information, all refer to the topic	3
2. Full-fills team roles and duties	Does not perform any duties assigned to the team role	Performs very little duties	Performs nearly all duties	Performs almost all duties	Performs all duties of assigned team roles	2
3. Shares work equality	Always relies on others to do the work	Rarely does the assigned work, often needs reminding	Usually does the assigned work, rarely needs reminding	Always does the assigned work, rarely needs reminding.	Always does the assigned work, without needing reminding	5
4. Listening skills	Is always talking, never allows anyone to else to speak	Usually does most of the talking, rarely allows others to speak	Listens, but sometimes talk too much,	Listens and talks a little more than needed.	Listens and talks a fare amount	3
					Total marks	ceil(13/4) = 4

(ii) Model of rubrics for assessing student activity

(iii) CIE/IA Tests (20 Marks)

Three tests have to be conducted in accordance with the test pattern given below and average marks of them are considered for CIE/IA with specified schedule.

(iv) Format of CIE/IA test question paper

CIE Question Paper							
Institution Name and Code							
Course Co-ordinator/Teacher							
Program Name		***Test No.***		*Units*			
Class/Sem		*Date*		*CL*			
Course Name		*Time*		*COs*			
Course Code		*Max. Marks*		*POs*			
Note to students: Answer all questions							
Question No.	**Question**		Marks	**CL**	**CO**	**PO**	
1							
2							
3							
4							

Legends: PO-Program Outcome, CO-Course outcome, CL-Cognitive Level, R-Remember, U-Understand, A-Apply

Note: Internal choice may be given in each CO at the same cognitive level (CL).

(v) Model question paper for CIE

CIE Question Paper							
Institution Name and Code							
Course Co-ordinator/Teacher							
Program Name	Electronics & Communication	***Test No.***	1	*Units*	1 & 2		
Class/Sem	6thSem	*Date*	1/1/2017	*CL*	R/U/A		
Course Name	Industrial Automation	*Time*	10-11AM	*COs*	1 & 2		
Course Code	15EC61T	*Max. Marks*	20	*POs*	1, 2 & 3		
Note to students: Answer all questions							
No.	**Question**		Marks	**CL**	**CO**	**PO**	
1	Explain the working principle of SCR. OR Explain the working principle of TRIAC.		05	U/A	1	1,2,5,6 ,7,10	
2	Define power Electronics. Mention its applications.		05	R	1	1,2,5,6 ,7,10	
3	List the turn ON methods of SCR. Explain any two.OR Explain RC-triggering method to turn ON SCR.		05	R/U/ A	2	1,2,10	
4	Sketchand Explain Resonant commutation.		05	U/A	2	1,2,10	

Semester End-exam Evaluation (SEE)

(i) End-exam question-paper pattern

.Unit No.	Unit Name	Study Duration (Hrs.)	No. Questions for End-exam	
			5 marks Part - a	10 marks Part - b
I	Power Electronic Devices	10	1	2
II	Triggering and commutation of SCR	8	1	2
III	Choppers, Inverters and Cycloconverters	10	2	2
IV	Applications of Thyristors	6	2	1
V	Programmable Logic Controllers	10	1	2
VI	DCS and SCADA System	8	2	1
	Total	**52**	**09 (45 Marks)**	**10 (100 Marks)**

(ii) Model question paper

Course Title **: Industrial Automation**

Course Code **: 15EC61T** Time **: 3 Hrs**

Semester **: 6** Max. Marks**: 100**

Instructions*: 1. Answer any **SIX** question from **Part A** (5x6=30 Marks)*

*2. Answer any **SEVEN** full questions from **Part B** (7x10=70 Marks)*

Part A

1. Define power Electronics. Mention its applications.
2. Mention the different methods for protection of SCR
3. Define Cycloconverters. Explain its working principle.
4. Explain Two Quadrant chopper.
5. Discuss the importance of freewheeling diode
6. Write the circuit diagram for Light Dimmer circuit using DIAC and TRIAC.
7. Discuss Process Scanning of PLC.
8. Explain the concept of SCADA hardware.
9. Mention the features of SCADA.

Part B

1. Explain two transistor analogy of SCR with circuit diagram.
2. Sketch the V-I characteristics of TRIACand explain its working.
3. Explain RC-triggering method to turn ON SCR with circuit diagram.
4. Sketch and Explain Complementary commutation.
5. Sketch and explain Single phase to single phase midpoint cycloconverter.
6. Explain Four Quadrant chopper with circuit diagram.
7. Sketch the block diagram for Speed control of DC motors using Dual converters.
8. a) List and explain PLC Registers.
   b) Describe Retentive and Delay timer functions.
9. a) Define ladder diagram? Write and label its parts.
   b) Explain jump functions with example.
10. Sketch and explain typical SCADA system.

Model Question Bank

Course Title : **Industrial Automation**	Course Code: **15EC61T**

UNIT-1.Power Electronic Devices

05 Marks

Remember

1. What is the relevance of power electronics? Mention its applications.
2. Define holding and Latching current in SCR
3. List the features of power diode
4. What is the function of SCR? List its applications
5. List the applications of SCR and define holding current.
6. List the applications of IGBT and power BJT.
7. How does SCR switch differ from diode switch?

Understand

1. Distinguish between SCR and TRIAC
2. Classify the types of power semiconductor devices.
3. Explain the working of SCR.
4. Explain the characteristics of power diode.
5. Explain the characteristics of IGBT.
6. Discuss the structure of power MOSFET.
7. Discuss the structure of power BJT.
8. Discuss the structure/construction of IGBT.
9. Explain the characteristics of power BJT.
10. Explain the characteristics of MOSFET
11. Explain the structure of SCR.
12. Explain two transistor analogy of SCR.
13. Compare DIAC and TRIAC.
14. Compare SCR and TRIAC.
15. Discuss the importance of freewheeling diode.
16. ExplainFull wave mid-point controlled rectifier

Applying

1. Draw switching times characteristics of BJT and explain.
2. Write the V-I characteristics of SCR.
3. Sketch the circuit of Single Phase half wave controlled rectifier
4. Sketch the circuit of Full wave mid-point controlled rectifier
5. Sketch the circuit of Full wave bridge controlled rectifier
6. Sketch the circuit of Half wave bridge controlled rectifier

Evaluate

1. Compare IGBT and MOSFET.
2. Compare BJT and MOSFET.
3. Evaluate the expression for anode current of SCR.
4. Chose the suitable circuit for mid-point controlled rectification and explain.
5. Summarise the applications of Thyristors.
6. Evaluate the expression for two transistor analogy of SCR.

10 Marks

Remember

1. Define power electronics. Mention any 8 applications of power electronics.
2. Name any 5 applications of SCR and IGBT each.

Understand

1. Explain the characteristics and working principle of power BJT.
2. Explain the characteristics and working principle of MOSFET.
3. Differentiate BJT, IGBT and MOSFET.
4. Differentiate SCR, TRIAC and DIAC.
5. Explain two transistor analogy of SCR with circuit diagram.

Applying

1. Sketch the V-I characteristics of SCRand explain its working.
2. Sketch and explain the characteristics of IGBT.
3. Sketch and explain the Single Phase half wave controlled rectifier
4. Sketch and explain the Full wave mid-point controlled rectifier
5. Sketch and explain the Full wave bridge controlled rectifier
6. Sketch and explain the Half wave bridge controlled rectifier

UNIT-2.Triggering and commutation of SCR

05 Marks

Remember

1. Define Triggering and Commutation of SCR.
2. List the turn ON methods of SCR. Explain any two.
3. Define natural and forced commutation. List the types.
4. Mention the different methods for protection of SCR.
5. List the types of Commutation methods.

Understand

1. Explain briefly the turn ON methods of SCR.
2. Compare Natural and forced commutation.
3. Briefly explain Naturalcommutation, forcedcommutation and resonant commutation.
4. Explain snubber circuit to protect SCR.
5. Explain over voltage and over current protection of SCR.
6. Explain dv/dt protection of SCR.
7. Explain Gate protection of SCR.

Applying

1. Sketch and Explain Resonant commutation
2. Sketch the circuit forAuxiliary commutation
3. Sketch the circuit forComplementary commutation
4. Write the neat circuit diagram of SCR being triggered by UJT.
5. Sketch the circuit for RC-triggering method to turn ON SCR.
6. Sketch and explain R-triggering method to turn ON SCR.

10 Marks

Remember

1. List the types of Commutation methods. Explain any two methods.
2. List the different triggering methods of SCR and explain.

Understand

1. Explain the different methods for protecting the SCR.
2. Explain RC-triggering method to turn ON SCR with circuit diagram.

Applying

1. Sketch and explain pulse triggering using UJT relaxation oscillator to turn ON SCR.

2. Sketch and Explain Auxiliary commutation
3. Sketch and Explain Complementary commutation

UNIT-3Choppers, Inverters and Cycloconverters
05 Marks

Remember

1. Define Chopper. Mention its applications.
2. Define Inverter. Mention its applications.
3. Define Cycloconverter. Mention its applications.
4. Define Step-up and step-down chopper.
5. Define Cycloconverters. Explain its working principle.

Understand

1. Explain the basic principle of chopper operation
2. Explain different Chopper control Schemes
3. Explain the working principle of Step-up chopper
4. Explain the working principle of step-down chopper
5. Classify the chopper. Explain First Quadrant chopper.
6. Explain Second Quadrant chopper.
7. Explain Two Quadrant chopper.
8. Explain Four Quadrant chopper.
9. Write a short note on Inverters.
10. Classify the inverters based on commutation and explain.

Applying

1. Write a short note on Voltage source inverter
2. Write a short note on current source inverter
3. Sketch and explain the working principle of Series Inverter
4. Sketch and explain the working principle of Full Bridge Inverter
5. Write the circuit diagram of Single phase to single phase midpoint cycloconverter.
6. Sketch and explain the working principle of Half Bridge Inverter

Evaluate

1. Compare Voltage source inverter and current source inverter
2. Summarise the applications of Cycloconverter.
3. Summarise the applications of Inverters.
4. Predict and sketch the waveform of PWM techniques used in inverters.
5. Evaluate the expression for duty cycle of chopper and explain.

10 Marks

Understand

1. Explain Four Quadrant chopper with circuit diagram.
2. Explain PWM techniques used in inverters

Applying

1. Sketch and explain Single phase to single phase midpoint cycloconverter.
2. Sketch and explain the working principle of Variable DC linkinverter.

UNIT-4 Applications of Thyristors
05 Marks

Understand

1. Explain over voltage protection of motors.
2. Discuss over current protection of motors.
3. Explain Light Dimmer circuit using DIAC and TRIAC
4. Explain Burglar Alarm circuit using SCR

Applying

1. Sketch the block diagram for Speed control of DC motors using Dual converters
2. Sketch the block diagram for speed control of single phase Induction motor
3. Sketch the block diagram for speed control of three phase Induction motor
4. Write the circuit diagram for Photo Electric Control of SCR
5. Write the circuit diagram for Light Dimmer circuit using DIAC and TRIAC.
6. Sketch the circuit of Burglar Alarm circuit using SCR.
7. Sketch the block diagram for Armature voltage control method for speed control of DC shunt motor
8. Sketch the block diagram for Armature Field control method for speed control of DC shunt motor

10 Marks

Understand

1. Explain thePhoto Electric Control of SCR with circuit diagram.
2. Explain Light, Dimmer circuit using DIAC and TRIAC with circuit diagram.
3. Sketch and explain the Burglar Alarm circuit

Applying

1. Sketch and explain the Armature voltage control method for speed control of DC shunt motor
2. Sketch and explain the Armature Field control method for speed control of DC shunt motor
3. Sketch and explain the Speed control of DC motors using Dual converters
4. Sketch and explain the speed control of single phase Induction motor
5. Sketch and explain the speed control of three phase Induction motor

UNIT-5 Programmable Logic Controllers

05 Marks

Remember

1. Define PLC. Explain its advantages.
2. List the hardware components of PLC.
3. Define ladder diagram? Write and label its parts.
4. List the any 5 symbols used in ladder diagrams.
5. List and explain PLC Registers.
6. List and explain PLC timers with examples.

Understand

1. Explain overall PLC system.
2. Discuss Process Scanning of PLC.
3. Explain the significance of Ladder diagram in PLC programming.
4. Describe General characteristics of Registers
5. Explain Up/down Counter with examples
6. Explain Holding Registers, and Input & Output Registers

Applying

1. Write the ladder diagram, truth table for basic logic gates.
2. Write the ladder diagram and truth table for the expression Y=(A and B) or C
3. Describe Retentive and Delay timer functions.
4. Write short note on PLC up/down counter.
5. Differentiate between relay logic panel & PLC based control panel.

Create

1. Design ladder diagram for Demorgan's theorem expressions.

2. Construct ladder diagram for the Boolean expression $Y=(AB+\bar{B}C+\overline{CD})$
3. Write the block diagram of PID module.
4. Prepare the list of functional features of Ladder diagram.
5. Prepare the list of functional features of PLC.

10 Marks

Remember

1. a) Define PLC. Explain its advantages
   b)List and explain PLC Registers
2. a)Define ladder diagram? Write and label its parts
   b) List any five symbols used in ladder diagrams

Understand

1. Define PID? Explain its control process with respect to PLC.
2. Explain PLC timers with diagram.
3. Explain jump with return and non return functions

Applying

1. Write the block diagram of overall PLC system and explain.
2. Write the ladder diagram, truth table for basic logic gates and explain.
3. Write the ladder diagram and truth table for the following expressions:
   (i)Y1=(A and B) or C, (ii) Y2= (A or B) and C.

UNIT-6 DCS and SCADA System

05 Marks

Remember

1. Define SCADA. List its features.
2. Define DCS. Mention its features.
3. Mention the features of SCADA.
4. List the applications of SCADA.
5. List the Advantages of DCS.

Understand

1. Explain concept of HMI and MMI.
2. Explain the significance of SCADA.
3. Explain working of HMI with sketch
4. Explain working of MMI with sketch
5. Explain the concept of SCADA hardware.
6. Explain the concept of SCADA software.
7. Explain the method of interfacing SCADA with PLC.
8. Compare SCADA and PLC
9. Explain first(monolithic) generation architecture of SCADA.
10. Explain Second (distributed) generation architecture of SCADA.
11. Explain third (Networked) generation architecture of SCADA.

Application

1. Justify the interfacing of SCADA with PLC.
2. Describe SCADA hardware.
3. Describe SCADA software.
4. Write the block diagram of fourth generation SCADA architecture.
5. Write the block diagram of hierarchical architecture of DCS.

10 Marks

Understand

1. Describe SCADA hardware and software.
2. Explain the block diagram of DCS system.
3. Explain fourth (Internet) generation architecture of SCADA.
4. Explain the concept of SCADA hardware and software.

Application

1. Sketch and explain elements of SCADA System.
2. Sketch the block diagram for second and third generation SCADAarchitectureand explain.

End

Government of Karnataka
Department of Technical Education
Board of Technical Examinations, Bengaluru

Course Title :**Embedded Systems**	Course Code: **15EC62T**
Semester : **6**	Course Group: **CORE**
Teaching Scheme in Hrs (L:T:P) : **4:0:0**	Credits : **4**
Type of course: **Lecture + activity**	Total Contact Hours: **52**
CIE : **25 Marks**	SEE : **100 Marks**

Prerequisites

Basics of digital Systems and programming.

Course Objectives

1. To understand the basic concepts and applications of embedded systems.
2. To introduce the architectural features and application capabilities of MSP430.

Course Outcomes

On completion of the course, students will be able to

Course Outcome		CL	Linked PO	Teaching Hrs
CO1	Understand the concept, classification, characteristics, quality attributes and applications of Embedded Systems.	***R/U/A***	1,2,5,6,10	**6**
CO2	Understand the architecture of embedded system and basics of real-time operating system.	***U/A/AN/EV***	1,2,10	**9**
CO3	Understand the architecture, addressing modes and applications of MSP430.	***U/A/AN***	1,2,3,4,10	**10**
CO4	Analyse instruction set of MSP430 and develop programs for control applications using assembly language and embedded C.	***U/A/EV/C***	1,2,3,4,10	**9**
CO5	Use ADC and comparator for simple applications.	***U/A//EV***	1,2,3,4,10	**8**
CO6	List and describe the features of Mixed Signal System using comparator and ADC.	***U/A/AN***	1,2,3,4,10	**7**
Total sessions including 3hrs student activity				**52**

Legends: PO-Program Outcome, CO-Course Outcome, CL-Cognitive Level, R-Remember, U-Understand, A-Apply, AN-Analyse, EV-Evaluate, C-Create

Mapping Course Outcomes with Program Outcomes

Course Outcomes	Programme Outcomes									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	*	*	--	--	*	*	--	--	--	*
CO2	*	*	--	--	--	--	--	--	--	*

CO3	*	*	*	*	--	--	--	--	--	*
CO4	*	*	*	*	--	--	--	--	--	*
CO5	*	*	*	*	--	--	--	--	--	*
CO6	*	*	*	*	--	--	--	--	--	*

***Legend**: * Linked, -- No link*

Course-Po Attainment Matrix

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
Embedded Systems	**3**	**3**	**3**	**3**	**1**	**1**	**--**	**--**	**--**	**3**

***Legend**: Addressing levels: 1-Slight, 2-Moderate, 3-Substantial, -- Not addressed*

***Quantification Method:** This is to relate the level of PO with the number of hours devoted to the COs which address the given PO. If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3; if 25 to 40% , Level 2; if 5 to 25%, Level 1; and if < 5%, not addressed.*

Course content and pattern of marks for SEE

Unit No	Unit Name	Hour	Questions to be set ForSEE						Marks Weightage	Weightage (%)
			R	U	A	AN	EV	C		
1	Introduction to embedded system	6	05	10	--	--	--	--	15	11
2	Architecture of Embedded System	9	--	10	10	05	05	--	30	20
3	Introduction to MSP430 Architecture	10	--	10	15	05	--	--	30	20
4	MSP430 Assembly and Embedded C Programming	9	--	10	10	--	05	05	30	20
5	MSP430 GPIO, Timer and On-chip Peripherals	8	--	10	10	05	--	--	25	18
6	MSP430: Mixed Signal Systems	7	--	05	10	--	--	--	15	11
	Total	**52**	**05**	**55**	**55**	**15**	**10**	**05**	**145**	**100**

Legend: R- Remember, U-Understand A-Application,AN-Analyse,EV-Evaluate, C-Create

Course Content

Unit-1: Introduction toEmbedded System Duration: 6hrs

Embedded System-Definition, History, Classification, Major Application Areas, Purposewith example,Embedded system vs. General Computing system, Characteristics and quality attributes of Embedded System, Application Case study: Smart running shoes

Unit-2: Architecture of Embedded SystemDuration: 9hrs

Hardware Architecture: Elements of Embedded System,Block diagram**,** Core of embedded system, Memory, Sensors and Actuators, Communication Interface, timing circuits-reset, watchdog timer, brownout protection and RTC, PCB and Passive components.**Software Architecture**: Embedded Firmware, Operating System Basics,Characteristics and role of RTOS in embedded systems, Software Architecture of an Embedded System.

Unit-3: Introduction to MSP430 Architecture Duration: 10hrs

MSP430: Features of MSP430 suitable embedded application, Different families and naming of MSP430, **MSP430 Architecture:** Data sheet reading of MSP430-TheOutside View—Pin-Out, The Inside View—Functional Block Diagram. **Central Processing Unit:**Program Counter (PC), Stack Pointer (SP), Status Register (SR), Constant Generators, General-Purpose Registers, Memory, Memory-Mapped Input and Output, Clock Generator, **Exceptions:** Interrupts and Resets**Addressing Modes:**Register Mode, Indexed Mode, Indirect Register Mode, Indirect Auto-increment Register Mode.Low-Power Modes of Operation of MSP430.Comparison of MSP430 and 8051 Architectures.

Unit-4: MSP430 Assembly and Embedded C Programming Duration: 9hrs

MSP430 Instruction Set: Classification-Constant Generator and Emulated Instructions**, Movement** Instructions, Arithmetic and Logic Instructions with Two Operands, Shift and Rotate Instructions, Flow of Control instructions. Simple assembly language programs.**Program development:** Features of **e**mbedded C as applicable to MSP430**,** development environment, simple Embedded C programs such as programs to control LEDs, access switches, generating delays and so on.

Unit-5: MSP430 GPIO, Timer and On-chip Peripherals Duration: 8hrs

Digital Input-Output: Non Interruptible I/O and Interruptible I/O: Pin logic diagram Different Control Register, Port register Table.**Timers:**Classification of timers. Timer_A- Block diagram, Capture/Compare channels, interrupts and application notes.**Watchdog Timer:**Features and applications.**Hardware Multiplier:**Features and applications.**LCD Driver**: LCD Driver features.

Unit-6: MSP430: Mixed Signal Systems Duration: 7hrs

Comparator A: Architecture,operation and applications of comparator. Use of comparator for Capacitative Touch Sensing. **ADCs:** Architecture ,Features of ADC 10 and ADC 12. Use of ADC10 for simple temperature Sensing.

References

1. *Introduction to Embedded Systems*- K V Shibu , McGraw Hill-ISBN-978-0-0701-4589-4
2. *MSP430 Microcontroller Basics* - John Davies, Elsevier, 2008 – ISBN-978-0-7506-8276-3
3. *Embedded Systems Design Using the TI MSP430 Series, 1st Edition* - Chris Nagy, Elsevier, 2003 – ISBN- 9780750676236
4. *Analog and Digital Circuits for Electronic Control System Applications-Using the TI MSP430 Microcontroller*- Jerry Luecke, Elsevier, 2004- ISBN-978-0-7506-7810-0

5. *Introduction to Embedded Systems Using Microcontrollers and the MSP430*-Manuel Jiménez, Rogelio Palomera, IsidoroCouvertier, Springer, 2014 – ISBN- 978-1-4614-3142-8
6. Texas Instrument MSP430 reference Page: http://www.ti.com/lsds/ti/microcontrollers_16-bit_32-bit/msp/overview.page
7. *IDE User Guide for MSP430:* 1)Code Composer Studio™ v6.1 for MSP430™ User's Guide:http://www.ti.com/lit/ug/slau157an/slau157an.pdf 2) IAR Embedded Workbench™ Version 3+ for MSP430™ User's Guide: http://www.ti.com/lit/ug/slau138an/slau138an.pdf 3) Energia is an open-sourced, community-driven IDE- http://energia.nu/guide/

Suggested List of Student Activities — Duration: 3hrs

***Note*:The following activities or similar activities for assessing CIE (IA) for 5 marks (Any one)**

Sl. No.	Activity	Duration (Hrs)
1	Install AR Embedded Workbench for MSP430/Code composer studio for MSP430/Energia for MSP430: Create Project from Scratch, debug and run any twoprograms in assembly and Embedded C. Example programs given below: 1. Data Transfer - Block move 2. Block Exchange 3. Addition/subtraction 4. multiplication 5. Division 6. Finding largest element in an array 7. Sorting 8. Code conversion: BCD – ASCII 9. Code conversion: ASCII – Decimal; Decimal - ASCII; 10. Code conversion :HEX - Decimal and Decimal – HEX	**3**
2	Any one activity from following list or similar activity. 1. Prepare a report on the case study on working of embedded system with respect to: a) Washing Machine b) Microwave Oven 2. Conduct case studies for working of embedded systems for the following topics: a) Air Conditioner b) Automobile 3. Conduct case studies for MSP430 embedded systems for any two topics. 4. List and Explain different types of sensors and actuators used in Embedded System	

Execution Mode

1. Every student should perform Project activity 1 and 2 independently as assigned by the teacher based on interest of the student. Student can also choose any other similar activity with a prior approval from the concerned teacher.
2. Project activities shall be carried out throughout the semester and present the project report at the end of the semester.
3. Report-size shall be qualitative and not to exceed 6 pages;
4. Each of the activity can be carried out off-class; however, demonstration/presentation should be done during laboratory sessions.
5. Assessment shall be made based on quality of activity, presentation/demonstration and report.
6. Assessment is made based on quality of work as prescribed by the following rubrics table.

Institutional Activities

Sl. No.	Activity
1	Organize Seminar, workshop or Lecture from experts on the topic embedded system Design.
2	Organize workshop from experts onMSP430 application development.

Course Delivery

The course will be delivered through lectures, presentations and support of modern tools.

Course Assessment and Evaluation Scheme

Assessment Method	What		To Whom	Assessment mode /Frequency /timing	Max. Marks	Evidence Collected	Course Outcomes
Direct assessment	CIE	IA	Students	Three tests+	20	Blue Books	1 to 6
				Activity*	05	Activity Sheets	1 to 6
	SEE	End exam		End of the course	100	Answer Scripts at BTE	1 to 6
				Total	125		
Indirect assessment	Student feedback on course		Students	Middle of the Course	Nil	Feedback Forms	1 to 3& Delivery of course
	End of course survey			End of the Course	Nil	Question-naires	1 to 6, Effectiveness of delivery instructions & assessment methods

Legends: CIE-Continuous Internal Evaluation, SEE- Semester End-exam Evaluation

+ Every I.A. test shall be conducted for 20 marks. Average of three tests, by rounding off any fractional part thereof to next higher integer, shall be considered for IA.

***S**tudents should do activity as per the list of suggested activities/ similar activities with prior approval of the teacher. Activity process must be initiated well in advance so that it can be completed well before the end of the term and assessed through appropriate Rubrics.

Questions for CIE and SEE will be designed to evaluate the various CLs as per the weightage shown in the following table.

Sl. No.	Cognitive Levels (CL)	Weightage (%)
1	Remembering	05
2	Understanding	35
3	Applying	35
4	Analyse	10
5	Evaluate	10
6	Create	05
	Total	**100**

Continuous Internal Evaluation (CIE) pattern

(i) Student Activity (5 marks)

The following student activities or similar activities can be assigned for assessing CIE (IA) marks

Sl. No.	Activity	Duration (Hrs)
1	InstallIAR Embedded Workbench for MSP430/Code composer studio for MSP430/Energia for MSP430: Create Project from Scratch, debug and run any twoprograms in assembly and Embedded C. Example programs given below: 1. Data Transfer - Block move 2. Block Exchange 3. Addition/subtraction 4. multiplication 5. Division 6. Finding largest element in an array 7. Sorting 8. Code conversion: BCD – ASCII 9. Code conversion: ASCII – Decimal; Decimal - ASCII; 10. Code conversion :HEX - Decimal and Decimal – HEX	**3**
2	Any one activity from following list or similar activity. 1. Prepare a report on the case study on working of embedded system with respect to: a) Washing Machine b) Microwave Oven 2. Conduct case studies for working of embedded systems for the following topics: a) Air Conditioner b) Automobile 3. Conduct case studies for MSP430 embedded systems for any two topics. 4. List and Explain different types of sensors and actuators used in Embedded System	

Execution Mode

1. Every student should perform Project activity 1 and 2 independently as assigned by the teacher based on interest of the student. Student can also choose any other similar activity with a prior approval from the concerned teacher.
2. Project activities shall be carried out throughout the semester and present the project report at the end of the semester.
3. Report-size shall be qualitative and not to exceed 6 pages;
4. Each of the activity can be carried out off-class; however, demonstration/presentation should be done during laboratory sessions.
5. Assessment shall be made based on quality of activity, presentation/demonstration and report.
6. Assessment is made based on quality of work as prescribed by the following rubrics table.

(ii) Model of rubrics for assessing student activity

Dimension	Scale					Marks (Example)
	1 Unsatisfactory	2 Developing	3 Satisfactory	4 Good	5 Exemplary	
1. Research and gathering information	Does not collect information relate to topic	Collects very limited information, some relate to topic	Collects basic information, most refer to the topic	Collects more information, most refer to the topic	Collects a great deals of information, all refer to the topic	3
2. Full-fills team roles and duties	Does not perform any duties assigned to the team role	Performs very little duties	Performs nearly all duties	Performs almost all duties	Performs all duties of assigned team roles	2
3. Shares work equality	Always relies on others to do the work	Rarely does the assigned work, often needs reminding	Usually does the assigned work, rarely needs reminding	Always does the assigned work, rarely needs reminding.	Always does the assigned work, without needing reminding	5
4. Listen to other team mates	Is always talking, never allows anyone to else to speak	Usually does most of the talking, rarely allows others to speak	Listens, but sometimes talk too much,	Listens and talks a little more than needed.	Listens and talks a fare amount	3
					Total marks	ceil(13/4)= 4

(iii) CIE/IA Tests (20 Marks)

Three tests have to be conducted in accordance with the test pattern given below and average marks of them are considered for CIE/IA with specified schedule.

(iv) Format of CIE/IA test question paper

CIE Question Paper								
Institution Name and Code								
Course Co-ordinator/Teacher								
Program Name		***Test No.***		*Units*				
Class/Sem		*Date*		*CL*				
Course Name		*Time*		*COs*				
Course Code		*Max. Marks*		*POs*				
Note to students: Answer all questions								
Question No.	**Question**		Marks	**CL**		**CO**		**PO**
1								
2								
3								
4								

Legends: PO-Program Outcome, CO-Course outcome, CL-Cognitive Level, R-Remember, U-Understand, A-Apply
Note: Internal choice may be given in each CO at the same cognitive level (CL).

(v) Model question paper for CIE

CIE Question Paper					
Institution Name and Code					
Course Co-ordinator/Teacher					
Program Name	Electronics and Communication	***Test No.***	1	*Units*	1 & 2
Class/Sem	5thSem	*Date*	1/1/2017	*CL*	R/U/A
Course Name	Embedded Systems	*Time*	10-11AM	*COs*	1 & 2
Course Code	15EC54A	*Max. Marks*	20	*POs*	1, 2,5.6 & 10

Note to students: Answer all questions

No.	**Question**	Marks	**CL**	**CO**	**PO**
1	Define Embedded System. Distiguish this from general purpose system. OR Explain the various possible purposes of using and embedded system	05	R/U/A	1	1,2,10
2	Explain the characteristics of an embedded system.	05	U/A	1	1,2,5,6
3	Write short note on Commercial off-the-shelf Component (COTS). Explain the role of COTS in Embedded System. OR Differentiate between SRAM and DRAM.	05	U/A	2	1,2,10
4	Explain the role of Brown-out Protection Circuit in Embedded System.	05	A	2	1,2,10

Semester End-exam Evaluation (SEE)

(i) End-exam question-paper pattern

.Unit No.	Unit Name	Study Duration (Hrs.)	No. Questions for End-exam	
			5 marks Part - a	10 marks Part - b
I	Introduction to embedded system	6	1	1
II	Architecture of Embedded System	9	2	2
III	Introduction to MSP430 Architecture	10	2	2
IV	MSP430 Assembly and Embedded C Programming	9	2	2
V	MSP430 GPIO, Timer and On-chip Peripherals	8	1	2
VI	MSP430: Mixed Signal Systems	7	1	1
	Total	**52**	**09 (45 Marks)**	**10 (100 Marks)**

(ii) Model question paper

Course Title **: Embedded Systems**
Course Code **: 15EC54A** Time **: 3 Hrs**
Semester **: 5** Max. Marks**: 100**
Instructions*: 1. Answer any **SIX** question from **Part A** (5x6=30 Marks)*
*2. Answer any **SEVEN** full questions from **Part B** (7x10=70 Marks)*

Part A

1. Define Embedded System. Distiguish this from general purpose system.
2. Explain the components of a typical Embedded System.
3. Write short note on Digital Signal Processor (DSP). Explain the role of DSP in Embedded System.
4. Explain the low power modes of MSP430 microcontroller.
5. Tabulate CPU Registers of MSP430 microcontroller.
6. Explain Layout of Assembly Language.
7. Explain MSP430 shift and rotate instructions.
8. Explain MSP430 Interruptible I/O with pin logic diagram.
9. Explain Architecture of MSP430 Comparator_A with block diagram.

Part B

10. Explain the Quality Attributes of an embedded system
11. Explain the role of following Circuit in Embedded System a) Real-Time Clock b) Watchdog Timer
12. Tabulate different types of memory used in Embedded System and explain their role of each.
13. a) Explain the memory mapping of MSP430 microcontroller.
    b)Write short note on MSP430 Status Register.
14. Explain the addressing modes of MSP430 microcontroller.
15. Explain aspect of Embedded C Program a)Declarations b) Shifts c) Low-Level Logic Operations d) Masks to Test Individual Bits e) Bit Fields f) Unions

16. Write MSP430 assembly and C program to flash LEDs with a frequency of roughly 1Hz using a software delay
17. Explain Hardware Multiplier with hardware multiplier registers. List the advantage of Hardware multiplier.
18. a) Explain Architecture of MSP430 ADC10 with block diagram.
    b) Describe how we can use ADC10 in Temperature sensor.

Model Question Bank

Course Title : **Embedded Systems**	Course Code: **15EC62T**

UNIT-1Introduction to embedded system

05 Marks

Remember

1. List classification of embedded systems
2. List some applications of embedded systems

Understand

1. Define Embedded System with the help of an example
2. Define Embedded System. Distinguish this from general purpose system.
3. Explain the various possible purposes of using and embedded system
4. Explain the characteristics of an embedded system
5. Explain the Operational Quality Attributes of an embedded system
6. Write short note on the non-Operational quality attributes of an embedded system.
7. Write short note on History of an embedded system.

Application

1. Differentiate between general purpose computers & embedded systems
2. Explain major application areas of an embedded system.
3. Explain the characteristics of an embedded system.
4. Summarize the Purpose of an embedded system.

10 Marks

Understand

1. a) Define Embedded System with the help of an example
   b) List the working elements of an embedded system
2. a) List some applications of embedded systems
   b) Explain the various possible purposes of using and embedded system

Application

1. Explain the characteristics of an embedded system
2. Explain the Quality Attributes of an embedded system

UNIT-2Architecture of Embedded System

05 Marks

Remember

1. Tabulate the components used as core of Embedded System
2. List different types of RAM used in Embedded System.
3. List different on-board Communication Interfaces.
4. List different external Communication Interfaces.

Understand

1. Explain the components of a typical Embedded System.
2. Define Application Specific Integrated Circuit (ASIC). Explain the role of ASIC in Embedded System.
3. Explain the advantage of flash over other program storage memory in Embedded System Design.
4. Define Sensor. Explain the role in Embedded System with example.
5. Define Actuator. Explain the role in Embedded System with example.
6. Define Relay. List different types of relay.
7. Explain the role of Rest Circuit in Embedded System.
8. Explain the role of Brown-out Protection Circuit in Embedded System.
9. Explain the role of Real-Time Clock in Embedded System.
10. Explain the role of Watchdog Timer in Embedded System.

Application

1. Write short note on Digital Signal Processor (DSP). Explain the role of DSP in Embedded System.
2. Write short note on Programmable Logic Devices (PLD). Explain the role of PLD in Embedded System.
3. Write short note on Commercial off-the-shelf Component (COTS). Explain the role of COTS in Embedded System.
4. Write short note on Input and Output subsystem of Embedded System.
5. Write short note on Relay. Explain the role of in Embedded System.

Analyse

1. Differentiate between ASIC and ASSP.

Evaluate

1. Comparison of Microprocessor and Microcontroller.
2. Explain RAM and ROM.
3. Importance of SRAM and DRAM.

10 Marks

Understand

1. a) Define Sensor. Explain the role in Embedded System with example.
   b) Define Actuator. Explain the role in Embedded System with example.
2. Explain the role of following Circuit in Embedded System a) Rest Circuit b) Brown-out Protection Circuit
3. Explain the role of following Circuit in Embedded System a) Real-Time Clock b) Watchdog Timer
4. a) Define Sensor. Explain the role in Embedded System with example.
   b) Define Actuator. Explain the role in Embedded System with example

Application

1. Tabulate the components used as core of Embedded System. Explain the merits and drawbacks.
2. Explain different categories of core of the Embedded System.
3. Tabulate different types of memory used in Embedded System and explain their role of each.
4. Explain different Input and Output subsystem of Embedded System.
5. Explain different on-board Communication Interfaces in brief.
6. Explain different external Communication Interfaces in brief.
7. Explain Communication Interfaces with respect to embedded system.

UNIT-3 Introduction to MSP430 Architecture

05 Marks

Remember

1. List the features make the MSP430 suitable for low-power and portable applications.
2. List the features of MSP430 microcontroller.
3. List the functions of different pins of MSP430.
4. List the addressing modes of MSP430 microcontroller.

Understand

1. Explain naming and different families of MSP430.
2. Explain the low power modes of MSP430 microcontroller.
3. Explain MSP430 Clock generator.
4. Write short note on MSP430 Exceptions.

Application

1. Explain the architecture of MSP430 microcontroller with block diagram.
2. Explain the memory mapping of MSP430 microcontroller.
3. Tabulate CPU Registers of MSP430 microcontroller.
4. Write short note on MSP430 Status Register.
5. Explain the Constant Generator and Emulated Instructions of MSP430 microcontroller.

Analyse

1. Compare the 8051 and MSP430 Architecture

10 Marks

Understand

1. a) Explain naming and different families of MSP430.
   b) Explain the low power modes of MSP430 microcontroller.
2. a) Explain the memory mapping of MSP430 microcontroller.
   b)Write short note on MSP430 Status Register.

Application

1. Explain the architecture of MSP430 microcontroller with block diagram.
2. Explain the CPU of MSP430 microcontroller with diagram.
3. Explain the addressing modes of MSP430 microcontroller.

UNIT-4MSP430 Assembly and Embedded C Programming

05 Marks

Remember

1. List MSP430 different category of instruction set.

Understand

1. Explain Sizes and Types of Variables in Embedded C.
2. Explain Coding Guidelines for C.
3. Explain Layout of Assembly Language.

Application

1. Explain MSP430 flow control instructions.
2. Explain MSP430 movement instruction and stack operation.
3. Explain MSP430 arithmetic instructions with one and two operands.
4. Explain MSP430 logical instructions with one and two operands.
5. Explain MSP430 byte manipulation instructions and Operations on Bits in Status Register instructions.
6. Explain MSP430 shift and rotate instructions.

Create

1. Write MSP430 assembly program to light the LEDs

2. Write MSP430 assembly program to light LED when button is pressed.
3. Write MSP430 assembly program to flash LEDs with a frequency of roughly 1Hz using a software delay
4. Write MSP430 C program to light the LEDs
5. Write MSP430 C program to light LED when button is pressed.
6. Write MSP430 C program to flash LEDs with a frequency of roughly 1Hz using a software delay

10 Marks

Understand

1. Explain aspect of Embedded C Program a)Declarations b) Shifts c) Low-Level Logic Operations d) Masks to Test Individual Bits e) Bit Fields f) Unions
2. a) Explain Layout of Assembly Language.
   b) Write MSP430 assembly code for data transfer-block move.

Application

1. Explain Editor, Assembler/Compiler, Linker, Stand-alone Simulator, Embedded emulator/debugger, Flash programmer and IDE.
2. Explain MSP430 instruction set. a) arithmetic instructions b) flow control instructions
3. Write MSP430 assembly and C program to light the LEDs
4. Write MSP430 assembly and C program to light LED when button is pressed.
5. Write MSP430 assembly and C program to flash LEDs with a frequency of roughly 1Hz using a software delay

UNIT-5MSP430 GPIO, Timer and On-chip Peripherals

05 Marks

Understand

1. Explain Timer block in Timer_A.
2. Explain Timer_ACapture/Compare Channels.
3. Explain Timer_Acapture/compare control register
4. Explain advantage of Hardware multiplier.
5. Explain MSP430 Interrupts from Timer_A

Application

1. Explain MSP430 Non Interruptible I/O with pin logic diagram.
2. Explain MSP430 Interruptible I/O with pin logic diagram.
3. Explain MSP430 Timer_A with block diagram.
4. Explain Timer different Output modes for capture/compare channel.
5. Explain Watchdog Timer with control Register.
6. Explain Hardware Multiplier with hardware multiplier registers.
7. Explain MSP LCD driver with control registers.

Analyse

1. Differentiate between Non Interruptible I/O and Interruptible I/O

10 Marks

Understand

1. Explain Hardware Multiplier with hardware multiplier registers. List the advantage of Hardware multiplier.
2. a) Explain MSP430 Interrupts from Timer_A
   b) Explain Watchdog Timer with control Register.

Application

1. Explain MSP430 Non Interruptible I/O and Interruptible I/O with pin logic diagram, control registers.

2. Explain MSP430 Timer_A with block diagram and explain Timer block, Capture Channel.

UNIT-6 MSP430: Mixed Signal Systems

05 Marks

Understand

1. Explain operation of MSP430 Comparator_A
2. Explain Basic Operation of the ADC10.
3. ExplainBasic Operation of the ADC12.

Application

1. Explain Architecture of MSP430 Comparator_A with block diagram.
2. Describe how we can use Comparator_Ain Capacitative Touch Sensing.
3. Explain control register of Comparator_A.
4. Explain Architecture of MSP430 ADC10 with block diagram.
5. Describe how we can use ADC10 in Temperature sensor.
6. Describe Timing and Triggering options of ADC.
7. Explain control register of ADC10.

10 Marks

Understand

1. Explain Architecture and operation of MSP430 Comparator_A with block diagram
2. Explain Basic Operation of the ADC10 and ADC12.

Application

8. a) Explain Architecture of MSP430 Comparator_A with block diagram.
   b) Describe how we can use Comparator_A in Capacitative Touch Sensing.
9. a) Explain Architecture of MSP430 ADC10 with block diagram.
   b) Describe how we can use ADC10 in Temperature sensor.

End

Government of Karnataka
Department of Technical Education
Board of Technical Examinations, Bengaluru

Course Title	: **Medical Electronics**	Course Code	: **15EC63A**
Semester	: **6**	Course Group	: **Elective**
Teaching Scheme in Hrs (L:T:P)	: **4:0:0**	Credits	: **4**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **52**
CIE	: **25 Marks**	SEE	: **100 Marks**

Prerequisites

Knowledge of analog and digital circuits**,** measurement systems and transducers.

Course Objectives

1. Discussion of the issues involved in man-instrument interface
2. Understand the working principles of various therapeutic and monitoring systems
3. Discuss general principles of imaging systems
4. Familiarization of the techniques of biotelemetry and the standard practices of achieving patient safety

Course Outcomes

On successful completion of the course, the students will be able to attain the following COs

Course Outcome		CL	Linked PO	Teaching Hrs
CO1	Comprehension of the nature and origin of bio-signals from parts of human body and the relevant transducers required to detect such signals	***R/U/A***	1,2,6,7,10	8
CO2	Understand recording and analysis of prominent bio-signals of human	***R/U/A***	1,2,6,7	8
CO3	Familiarization with human assist devices	***R/U/A***	1,2,6,7,8	10
CO4	Understand the measurement and analysis techniques for physiological parameters	***R/U/A***	1,2,4,10	10
CO5	Understand the patient imaging and monitoring systems	***U/A***	1,2,5,6,9	9
CO6	Understand Biotelemetry, telemedicine, patient safety and E-waste management.	***U/A***	1,2,4,5,6,7,9 ,10	7
			Total	**52**

Legends: PO-Program Outcome, CO-Course Outcome, CL-Cognitive Level, R-Remember, U-Understand, A-Apply

Mapping Course Outcomes with Program Outcomes

Course Outcomes	Programme Outcomes									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	*	*	--	--	--	*	*	--	--	*
CO2	*	*	--	--	--	*	*	--	--	--
CO3	*	*	--	--	--	*	*	*	--	--
CO4	*	*	--	*	--	--	--	--	--	*
CO5	*	*	--	--	*	*	--	--	*	--
CO6	*	*	--	*	*	*	*	--	*	*

Legend : * Linked, -- No link

Course-PO attainment matrix

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
Medical Electronics	**3**	**3**	**0**	**2**	**3**	**3**	**2**	**0**	**3**	**2**

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.
If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

Course content and pattern of marks for SEE

Unit No	Unit Name	Hour	Questions to be set For SEE			Marks	Weightage (%)
			R	U	A		
1	Bioelectric signals	8	5	5	10	20	14
2	Bio potential Recorders	8	5	10	10	25	17
3	Therapeutic Equipment	10	10	10	10	30	21
4	Measurement and analysis techniques	10	10	10	10	30	21
5	Imaging systems	9	5	10	10	25	17

6	Biotelemetry and patient safety	7	5	5	5	15	10
	Total	**52**	**40**	**50**	**55**	**145**	**100%**

Legend: R- Remember, U-Understand A-Application

Course Contents

Unit - 1: Bioelectric signals 08 Hours

Cell characteristics. **Bio-electric potential**: Origin, Resting and action potential, depolarization and repolarisation, propagation of action potentials, ECG, EEG and EMG waveforms with typical charecteristics. **Electrodes**: Types, Electrodes used for ECG, EEG and EMG. Selection of physiological transducers.

Unit - 2: Bio potential Recorders 08 Hours

Basic recording systems. Block diagram of ECG, isolated preamplifier, ECG leads, effects of artifacts on ECG recordings, Multichannel ECG machine, Block diagram of EEG machine, 10-20 electrode placement system for EEG, and Evoked potential. Working of EMG with block diagram. Applications of ECG, EEG, EMG and ERG recordings.

Unit – 3: Therapeutic Equipment 10 Hours

Cardiac pacemakers- external and implantable pacemakers and programmable pacemaker. Defibrillator-internal and external, AC and DC defribrillators, block diagram of microprocessor-based defibrillator. Dialysis- working of a haemodialyser. Working of digital hearing aid. Diathermy- types, schematic of microwave diathermy unit, Surgical diathermy – principle , working of solid state surgical diathermy machine. Laser- different types of lasers and their applications in medicine, argon laser- block diagram of gastric photocoagulator. Electrotherapy – types of waveforms used, electrotherapeutic muscle stimulator.

Unit - 4: Measurement and analysis Techniques 10 Hours

Blood constituents- calculation of size of cells- MCV, MCH, MCHC, MPV, RDW& PDW, Blood cell counter- Coulter's method and Dark field method, Digital pH meter, Spectrophotometer, Oximetry - finger tip oximeter. Features of Blood flow meters. Ultrasonic Doppler-shift based FHR measurement. BP measurement-systolic & diastolic pressure, direct method and indirect methods, Bp measurement using ultrasonic doppler shift method, advantages & disadvantages. Rheographic method of indirect blood flow measurement.

Unit -5: Imaging systems 09 Hours

X-Rays- properties, X-ray imaging machine, applications, advantages and disadvantages. Computerized tomography- basic principle, block diagram of a typical CT imaging system, advantages, disadvantages and applications of CT imaging. Magnetic resonance imaging-principles of NMR imaging, basic components of a typical NMR imaging system, applications, advantages and disadvantages of magnetic resonance imaging. Ultra sonic imaging-properties of ultrasonic waves, basic pulse echo apparatus. Concept and features of patient monitoring system.

Unit- 6: Biotelemetry and Patient safety 07 Hours

Biotelemetry- Introduction, components of Biotelemetry a system, Single channel bio telemetry system, Applications of biotelemetry. **Telemedicine**-concept, essential parameters, telemedicine using mobile communication. **Patient safety-**Physiological effects of electric current, micro and macro shock- preventive measures, safety standards, effects of radiation exposure, SAR as applicable to mobile phones. **E-waste**- Sources and disposal.

References

1. *Hand book of Bio Medical Instrumentation(* 2nd edition)- R.S. Khandpur, ISBN-13: 9789339205430
2. *Introduction to Biomedical Instrumentation* –Mandeep Singh. ISBN-13: 9788120350236
3. *Principles of Medical Electronics and biomedical Instrumentation*- S.K. Guha ISBN-13: 978-8173712579
4. *Medical instrumentation Application and design J*.G.Webster(Wiley India) *ISBN*-13: 978-0471676003
5. *Biomedical Instrumentation* –Dr.M. Arumugam *ISBN* 13: 9788187721123.

Course Delivery

The course will be delivered through lectures, presentations and support of modern tools.

Course Assessment and Evaluation Scheme

Master Scheme

Assessment Method	What		To Whom	Assessment mode /Frequency /timing	Max. Marks	Evidence Collected	Course Outcomes
Direct assessment	CIE	IA	Students	Three tests+	**20**	Blue Books	1 to 6
				Activity*	**05**	Activity Sheets	1 to 6
	SEE	End exam		End of the course	**100**	Answer Scripts at BTE	1 to 6
				Total	**125**		
Indirect assessment	Student feedback on course		Students	Middle of the Course	Nil	Feedback Forms	1 to 3 Delivery of course
	End of course survey			End of the Course	Nil	Question-naires	1 to 6 Effectiveness of delivery instructions & assessment methods

Legends: CIE-Continuous Internal Evaluation, SEE- Semester End-exam Evaluation

+ Every I.A. test shall be conducted for 20 marks. Average of three tests, by rounding off any fractional part thereof to next higher integer, shall be considered for IA.

***S**tudents should do activity as per the list of suggested activities/ similar activities with prior approval of the teacher. Activity process must be initiated well in advance so that it can be completed well before the end of the term and assessed through appropriate Rubrics.

Questions for CIE and SEE will be designed to evaluate the various CLs as per the weightage shown in the following table.

Sl. No.	Cognitive Levels (CL)	Weightage (%)
1	Remembering	30
2	Understanding	30
3	Analyze	15
4	Applying	15
5	Evaluate	10
	Total	**100**

Continuous Internal Evaluation (CIE) pattern

(i) Student Activity (5 marks)

The following student activities or similar activities can be assigned for assessing CIE/IA marks

Sl. No.	Activity
1	Recent trends in medical imaging systems
2	Special considerations in the design of pressure transducers for medical applications
3	The role of wearable devices in biomedical applications
4	A report on principle of thermography, infrared imaging and applications of thermography in diagnostic medicine.
5	A report on circuits for controlling dialysate temperature and working of blood leak detectors used in haemodialysers
6	A visit to hospital or diagnostic centre with the objective of familiarization of working of medical electronics equipment

Execution Mode

1. At least one activity is mandatory for each batch of 4 students; carried throughout the semester and submit the report before the end of the semester.
2. Report shall be qualitative and not to exceed 4 pages.
3. Activity can be carried out off-class; however, demonstration/presentation should be done in the class room.
4. Teacher is expected to observe and record the progress of students' activities
5. Assessment is made based on quality of work as prescribed by the following **rubrics** table.

(ii) Model of rubrics for assessing student activity

Dimension	Scale					Marks (Example)
	1 Unsatisfactory	2 Developing	3 Satisfactory	4 Good	5 Exemplary	
1. Research and gathering information	Does not collect information relate to topic	Collects very limited information, some relate to topic	Collects basic information, most refer to the topic	Collects more information, most refer to the topic	Collects a great deals of information, all refer to the topic	3
2. Full-fills team roles and duties	Does not perform any duties assigned to the team role	Performs very little duties	Performs nearly all duties	Performs almost all duties	Performs all duties of assigned team roles	2
3. Shares work equality	Always relies on others to do the work	Rarely does the assigned work, often needs reminding	Usually does the assigned work, rarely needs reminding	Always does the assigned work, rarely needs reminding.	Always does the assigned work, without needing reminding	5
4. Listen to other team mates	Is always talking, never allows anyone to else to speak	Usually does most of the talking, rarely allows others to speak	Listens, but sometimes talk too much,	Listens and talks a little more than needed.	Listens and talks a fare amount	3
					Total marks	ceil(13/4)= 4

(iii) CIE/IA Tests (20 Marks)

Three tests have to be conducted, during specified schedule, in accordance with the test pattern given below and their average-marks shall be considered for CIE/IA.

(iv) Format of CIE/IA test question paper

CIE Question Paper								
Institution Name and Code								
Course Coordinator/Teacher								
Program Name		***Test No.***	1	*Units*				
Class/Sem		*Date*		*CL*				
Course Name		*Time*		*COs*				
Course Code		*Max. Marks*		*POs*				
Note to students: Answer all questions								
Question No.	**Question**			Marks	**CL**	**CO**	**PO**	
1								
2								
3								
4								

Legends: PO-Program Outcome, CO-Course outcome, CL-Cognitive Level, R-Remember, U-Understand, A-Apply

Note: Internal choice may be given in each CO at the same cognitive level (CL).

(v) Model question paper for CIE

CIE Question Paper						
Institution Name and Code						
Course Co-ordinator/Teacher						
Program Name	Electronics and Communication	***Test No.***	1	*Units*	1 & 2	
Class/Sem	6th Sem	*Date*	16/8/2016	*CL*	R/U/A	
Course Name	Medical Electronics	*Time*	10-11AM	*COs*	1 & 2	
Course Code	15EC6xT	*Max. Marks*	20	*POs*	1, 2 & 3	

Note to students: Answer all questions

No.	Question	Marks	CL	CO	PO
1	Explain a typical ECG waveform	05	R/U	1	1,2,3
2	List the factors on which the selection of a physiological transducer depends	05	R/A	1	1,2
3	Sketch the block diagram of a typical EEG machine	05	R/U	2	1,2
4	List the applications of ECG and EMG	05	R/A	2	1,2

Semester end-exam evaluation (SEE)

(i) End-exam question-paper pattern

Unit No.	Unit Name	Study Duration (Hrs.)	No. Questions for End-exam	
			5 Marks PART - A	10 Marks PART - B
1	Bioelectric signals	8	1	1.5
2	Bio potential Recorders	8	2	1.5
3	Therapeutic Equipment	10	2	2
4	Measurement and analysis techniques	10	2	2
5	Imaging systems	9	1	2
6	Biotelemetry and patient safety	7	1	1
	Total	**52**	**09 (45 Marks)**	**10 (100 Marks)**

(ii) Model question paper

Course Title **: Medical Electronics**
Course Code **: 15EC6xT** Time **: 3 Hrs**
Semester **: Sixth** Max. Marks**: 100**
Instructions*: 1. Answer any **SIX** question from **Part A** (5x6=30 Marks)*
*2. Answer any **SEVEN** full questions from **Part B** (7x10=70 Marks)*

Part A

1. List the factors that decide the selection of a physiological transducer

2. Explain the working of a basic recording system
3. Discuss the necessity of a isolated preamplifier in a ECG machine.
4. Differentiate between internal and external pacemakers
5. List the applications of lasers in medicine
6. Sketch the block diagram of a dark field type blood cell counter.
7. Compare direct and indirect methods of BP measurements
8. Explain the principle of obtaining M-mode display in ultrasound scanning
9. List the measures to be taken to minimize shock hazards in hospitals.

Part B

1. Write the frequency range and suggest a suitable transducer for the following signals (i)aterial BP(direct) (ii) Cardiac output (iii) body temperature (iv) phonocardiogram (v) ballistoocardiogram (10)
2. (a) Explain the different types of electrodes used in EMG recordings. (5)
   (b) list the effects of artifacts on ECG recordings (5)
3. Describe the 10-20 system of electrodes used in EEG . (10)
4. Explain the working of a programmable pacemaker(10)
5. (a) Sketch the block diagram of a fibre optic gastric photocoagulator (4)
   (b) Explain the working of a digital hearing aid (6)
6. (a) Define MCV, MCH, MCHC, MPV and RDW. (10)
   (b) Sketch the block diagram of finger tip oximeter (4)
7. Explain any method of Bp measurement (10)
8. Explain the working of a CT machine and list its advantages(8 + 2)
9. (a) Describe with a block diagram, the working of echocardiograph equipment (8)
   (b) List the applications of echocardiograph (2)
10. (a)Define biotelemetry.(2)
    (b)Describe the setup of a single channel biotelemetry system used for ECG(8)

Institutional activities (No marks)

The following are suggested institutional activities, to be carried out at least one during the semester. The course teacher/coordinator is expected to maintain the relevant record (Containing, Activity name, Resource persons and their details, duration, venue, student feedback, etc) pertaining to Institutional activities.

Sl. No.	Activity
1	Organize seminar, workshop or lecture from experts on recent developments in the field of medical electronics
2	Arrange field trips to reputed medical hospitals and diagnostic laboratories so that the students get a first hand knowledge of the medical equipments used.

Model Question Bank

Note: The questions in the question bank are indicative but not exhaustive. Sub-questions on different CLs may be combined in 10-marks questions or 10-marks questions can be splitted into if necessary keeping weightage of CLs approximately intact.

UNIT-1

5-mark questions

1. Define resting and action potentials. State the typical values.
2. List the factors on which the selection of a physiological transducer depends .

3. Describe the origin of ECG waveform
4. Suggest suitable transducers for monitoring oxygen level in blood and blood flow
5. State the frequency/amplitude range and transducers to be used for the following signals
   (i) Ballistocardiogram (ii)PH
6. Write a note on EEG wave patterns
7. Explain the different types of electrodes used in ECG recording

10-mark Questions

1. Write the frequency range and suggest a suitable transducer for the following signals (i)aterial BP(direct) (ii) Cardiac output (iii) body temperature (iv) phonocardiogram (v) ballistoocardiogram
2. (a) Explain the different types of electrodes used in EMG recordings. (5)
   (b) Explain briefly a typical EMG waveform
3. Explain the process of depolarization and repolarisation with a neat diagram.

UNIT-2

5-mark questions

1. Sketch the block diagram of a EEG equipment
2. Explain the working of a basic recording system
3. Justify the presence of isolated preamplifiers in ECG equipments
4. List the applications of EEG and EMG
5. List the effects of artifacts in ECG measurement.
6. Explain the types of bipolar leads used in ECG

10-mark Questions

1. Explain the block diagram of a typical ECG equipment. List the uses of ECG
2. Describe the working of EEG equipment
3. Explain how EMG recordings are made?.list the uses of EMG
4. Describe 10-20 system of EEG electrodes

UNIT-3

5-mark Questions

1. Differentiate between internal and external pacemakers
2. Write the block diagram of gastric photocoagulator
3. Explain the different types of waveforms used in electrotherapy
4. Sketch the schematic of a microwave diathermy setup
5. Differentiate between external and internal defibrillators

10-mark Questions

1. Describe the working of haemodialyser machine
2. State the need for electrotherapy. Explain the working of electrotherapeutic stulator
3. (a) list the advantages of diathermy over conventional heating pads(4)
   (b) Explain the working of a digital hearing aid(6)

4.Explain the working of a programmable pacemaker

UNIT-4

5-mark Questions

1. Differentiate between direct and indirect method of BP measurement
2. Sketch the block diagram of dark field type blood cell counter
3. Write the block diagram of coulter's type blood cell counter.
4. Explain the role of korotkoff's sounds in BP measurements
5. Write the block diagram of electromagnetic type blood flow meter

10-mark Questions

1. Define PH. Explain the working of digital PH meter
2. Explain the working coulter's type blood cell counter. List its advantages and disadvantages
3. Describe the working dark field type blood cell counter. List its advantages and disadvantages
4. Define MCHC. Explain the working of spectrophotometer
5. Explain the working of spectrophotometer. List its advantages
6. Describe ultrasonic doppler shift method of measuring BP
7. (a)Define MPV and RDW(4)
   (b) Describe the working of FHR monitor
8. Explain the working of electromagnetic blood flow meter and list its applications.

UNIT-5

5-mark Questions

1. List the properties of X-rays
2. List the properties of ultrasound
3. Mention the advantages, disadvantages and applications of X-ray imaging machine
4. Sketch the block diagram of x-ray imaging machine
5. list the advantages, disadvantages and applications of CT scan machine
6. Sketch the block diagram of CT scan machine
7. Describe the principle of obtaining M-mode display
8. Explain B-scan in ultrasound scanning
9. List the applications of echocardiograph
10. Write the block diagram of MRI scanner
11. list the advantages, disadvantages and applications of MRI scanner
12. Sketch the block diagram of a basic ultrasound pulsed echo scanner
13. list the advantages, disadvantages and applications of Ultrasound scanning

10-mark Questions

1. Explain the operation of ultrasound pulsed echo scanner
2. Describe the working of echocardiograph. List its applications
3. Explain the working of MRI scanner
4. Explain the working of CT scanner. list its advantages
5. Explain the operation of X- ray imaging machine. List its applications

UNIT-6

5-mark Questions

1. List the essential parameters of telemedicine
2. List the applications of telemedicine
3. List the ill effects of e-waste
4. Define e-waste. Explain any two methods of disposing e-waste
5. Classify the medical devices as per the safety standards
6. Write the physiological effects of radiation exposure
7. Explain micro shock and macro shock
8. List the preventive measures to prevent shock hazards in hospitals
9. Explain the physiological effects of electric current

10-mark Questions

1. Explain telemedicine using mobile communication
2. Define biotelemetry. Describe the working of single channel biotelemetry system used for ECG

End

Government of Karnataka
Department of Technical Education
Board of Technical Examinations, Bengaluru

Course Title	**: Advanced Microprocessors**	Course Code	: **15EC63B**
Semester	: **6**	Course Group	: **Elective**
Teaching Scheme in Hrs (L:T:P)	: **4:0:0**	Credits	: **4**
Type of course	: **Lecture + activity**	Total Contact Hours: **52**	
CIE	: **25 Marks**	SEE	: **100 Marks**

Prerequisites

Students should have knowledge of Microprocessor/Microcontroller Architecture and Programming.

Course Objectives

1. Study of architecture and programming of 8086 microprocessor
2. Study of features of different peripheral devices and standard buses
3. Know the features of advanced microprocessors

Course Outcomes

At the end of the course, the students should be able to

1. Understand the necessity, features and architecture of 8086.
2. Analyse the addressing modes and understand the functions of 8086 instructions.
3. Write simple assembly language programs.
4. Understand the need and handling of interrupts in 8086 and features of peripheral ICs.
5. Explain the architecture of generic advanced microprocessor and features of advanced microprocessors.
6. Understand the need and features of bus standards.

Course Outcome		CL	Linked PO	Teaching Hrs
CO1	Understand the necessity, features and architecture of 8086.	***R/U/A/AN/E/C***	1, 2,10	**8**
CO2	Analyse addressing modes and instructions of 8086.	***R/U/AN/E/C***	1,2,10	**10**
CO3	Write simple assembly language programs.	***R/U/A***	1,2,3,10	**10**
CO4	Understand the need and handling of interrupts in 8086 and features of peripheral ICs.	***R/U/A/AN***	2,10	**9**
CO5	Explain the architecture of generic advanced microprocessor and features of advanced microprocessors.	***R/U/A***	2,10	**10**
CO6	Understand the need and features of bus standards.	***R/U***	2,10	**5**
			Total Sessions	**52**

Legends: PO-Program Outcome, CO-Course Outcome, CL-Cognitive Level, R-Remember, U-Understand, A-Apply, AN-Analyse, E-evaluate , C-create

Mapping Course Outcomes with Program Outcomes

Course Outcomes	Programme Outcomes									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	*	*	--	--	--	--	--	--	--	*
CO2	*	*	--	--	--	--	--	--	--	*
CO3	*	*	*	--	--	--	--	--	--	*
CO4	--	*	--	--	--	--	--	--	--	*
CO5	--	*	--	--	--	--	--	--	--	*
CO6	--	*	--	--	--	--	--	--	--	*

***Legend**: * Linked, -- No link*

Course-PO Attainment Matrix

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
Advanced Microprocessors	**3**	**3**	**1**	**--**	**--**	**--**	**--**	**--**	**--**	**3**

***Legend**: Addressing levels: 1-Slight, 2-Moderate, 3-Substantial, -- Not addressed*

***Quantification Method:** This is to relate the level of PO with the number of hours devoted to the COs which address the given PO. If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3; if 25 to 40% , Level 2; if 5 to 25%, Level 1; and if < 5%, not addressed.*

Course content and pattern of marks for SEE

Unit No	Unit Name	Hrs.	Questions to be set For SEE						Marks Weightage	Weightage (%)
			R	U	A	AN	E	C		
1	Architecture of 8086 microprocessor	8	05	10	05	05	05	--	30	20
2	8086 Instruction set	10	05	10	--	05	05	05	30	21
3	8086 Programming	10	05	10	10	--	--	--	25	18
4	Interrupts and Peripheral ICs	9	05	05	05	05	--	--	20	14
5	Advanced Microprocessors	10	05	10	15	--	--	--	30	21
6	Bus Standards	5	05	05	--	--	--	--	10	06
	Total	**52**	**30**	**50**	**35**	**15**	**10**	**5**	**145**	**100**

Legend: R- Remember, U-Understand A-Application, AN-Analyse, E-evaluate, C-create

Course Content

UNIT-01: Architecture of 8086 microprocessor Duration -08Hrs.

Introduction to Microprocessors, Features, pin functions and internal architecture of 8086. Flag register, Memory segmentation, Segment Registers, Physical address - calculation with examples, Physical memory organization. Interfacing 8086 with memory and I/O devices under minimum mode (Block-diagram level), Comparison between Minimum mode and Maximum mode configuration

UNIT-02: 8086 Instruction set Duration -10Hrs.

Addressing modes - with example, Role of index and pointer registers. **8086 instruction set**- Data transfer, arithmetic, logical, shift and rotate, branching, loop control and string instructions, processor control instructions with simple examples.

UNIT-03: 8086 Programming Duration -10Hrs.

ALP program development cycle, development tools, MASM-Assembler directives, structure of assembly program, sample programs -with relevant comments- such as data transfer, code conversion, largest/smallest, sorting, searching, string palindrome and other simple programs. Comparison of procedure and macro.

UNIT-04: Interrupts and Peripheral ICs Duration -09Hrs.

Interrupts:-Concept, classification–internal and external, maskable and non-maskable, hardware and software. Interrupt Vector Table, interrupt cycle, interrupt service routine, and interrupt priorities. DOS and BIOS routines as interrupt service routines. **Programmable Peripheral ICs:** Functional block diagram, features, various operating modes of IC 8255. Features of 8253, 8259, 8251, & 8257. Relevance and features of 8087 co-processor.

UNIT-05: Advanced Microprocessors Duration -10Hrs.

Block diagram of Advanced Microprocessor, Memory Hierarchy, Cache memory, Virtual memory, Paging & segmentation, Pipe lining - Pipe line hazards. Features and comparison of 80286, 80386, 80486, Pentium IV. Concept of core processor. Introduction to Power PC, Features of Power PC601 and AMD Athlon Processor. Features and applications of Super SPARC Processor.

UNIT-06: Bus Standards Duration -5 Hrs.

Bus standards: Need for Bus standards. Features of RS232, Parallel Centronic Bus, SATA Bus, I^2C Bus. USB-Structure, operation and features.

References

A. K.Ray , K M Bhurchandi, “Advanced Microprocessor & Peripherals”, Tata McGraw Hill,3nd Edition,2013

1. Douglas V Hall, “Microprocessor & Interfacing: Programming and Hardware”, Tata McGraw Hill, 2nd Edition,2006.
2. BARRY B. BREY, " THE INTEL MICROPROCESSORS-Architecture, Programming, and Interfacing", Pearson Education India. Eighth Edition
3. Yn - cheng Liu and Gibson, G.A., “Microcomputer Systems: The 8086 / 8088Family Architecture, Programming and Design”, Prentice Hall of India, 2nd Edition, 2006.
4. Badri Ram , ‘’Advanced Microprocessors and Interfacing”’, McGraw Hill, 2014
5. Triebel, walter, Avatar singh," The 8088 and 8086 microprocessors : programming, interfacing, software, hardware, and applications : including the 80286, 80386, 80486, and Pentium processors", Prentice Hall, Fourth edition, 2003.
6. The SPARC Architecture Manual.

7. INTEL manual/data sheet.

Course Delivery

The course will be delivered through lectures, presentations and support of modern tools.

Course Assessment and Evaluation Scheme

Assessment Method	What		To Whom	Assessment mode /Frequency /timing	Max. Marks	Evidence Collected	Course Outcomes
Direct assessment	CIE	IA	Students	Three tests+	20	Blue Books	1 to 6
				Activity*	05	Activity Sheets	1 to 6
	SEE	End exam		End of the course	100	Answer Scripts at BTE	1 to 6
				Total	125		
Indirect assessment	Student feedback on course		Students	Middle of the Course	Nil	Feedback Forms	1 to 3 & Delivery of course
	End of course survey			End of the Course	Nil	Question-naires	1 to 6, Effectiveness of delivery instructions & assessment methods

Legends: CIE-Continuous Internal Evaluation, SEE- Semester End-exam Evaluation

+ Every I.A. test shall be conducted for 20 marks. Average of three tests, by rounding off any fractional part thereof to next higher integer, shall be considered for IA.

***S**tudents should do activity as per the list of suggested activities/ similar activities with prior approval of the teacher. Activity process must be initiated well in advance so that it can be completed well before the end of the term and assessed through appropriate Rubrics.

Questions for CIE and SEE will be designed to evaluate the various CLs as per the Weight age shown in the following table.

Sl. No.	Cognitive Levels (CL)	Weightage (%)
1	Remembering	20
2	Understanding	35
3	Applying	25
4	Analyse	8
5	Evaluate	7
6	create	5
	Total	**100**

Institutional Activities

Sl. No.	Activity
1	Organize Seminar, workshop or Lecture from experts on the modern trends in Processors

Dimension	Scale	Marks

Continuous Internal Evaluation (CIE) pattern

(i) Student Activity (5 marks)

The following student activities or similar activities can be assigned for assessing CIE (IA) marks

Sl. No.	Activity
1	Collect the features of Intel core processors (Dual, quad, i3, i5, i7)
2	Collect the features of core processors used in mobile phones (At least 5 processors)
	Execution Mode 1. Maximum of 4 students in each batch for student activity; every batch is expected perform both activities. 2. Write qualitative report of 4 to 6 pages; one report per batch. 3. Activities can be carried out off-class. 4. Teacher is expected to observe and record the progress of students' activities; Assessment shall be made based on the following rubrics table

(ii) Model of rubrics for assessing student activity

	1 Unsatisfactory	2 Developing	3 Satisfactory	4 Good	5 Exemplary	
1. Research and gathering information	Does not collect information relate to topic	Collects very limited information, some relate to topic	Collects basic information, most refer to the topic	Collects more information, most refer to the topic	Collects a great deals of information, all refer to the topic	3
2. Full-fills team roles and duties	Does not perform any duties assigned to the team role	Performs very little duties	Performs nearly all duties	Performs almost all duties	Performs all duties of assigned team roles	2
3. Shares work equality	Always relies on others to do the work	Rarely does the assigned work, often needs reminding	Usually does the assigned work, rarely needs reminding	Always does the assigned work, rarely needs reminding.	Always does the assigned work, without needing reminding	5
4. Listen to other team mates	Is always talking, never allows anyone to else to speak	Usually does most of the talking, rarely allows others to speak	Listens, but sometimes talk too much,	Listens and talks a little more than needed.	Listens and talks a fare amount	3
					Total marks	ceil(13/4)= 4

(iii) CIE/IA Tests (20 Marks)

Three tests have to be conducted in accordance with the test pattern given below and average marks of them are considered for CIE/IA with specified schedule.

(iv) Format of CIE/IA test question paper

CIE Question Paper					
Institution Name and Code					
Course Co-ordinator/Teacher					
Program Name		***Test No.***		*Units*	
Class/Sem		*Date*		*CL*	
Course Name		*Time*		*COs*	
Course Code		*Max. Marks*		*POs*	
Note to students: Answer all questions					

Question No.	**Question**	Marks	**CL**	**CO**	**PO**
1					
2					
3					
4					

Legends: PO-Program Outcome, CO-Course outcome, CL-Cognitive Level, R-Remember, U-Understand, A-Apply

Note: Internal choice may be given in each CO at the same cognitive level (CL).

(v) Model question paper for CIE

CIE Question Paper						
Institution Name and Code						
Course Co-ordinator/Teacher						
Program Name	Electronics and Communication	***Test No.***	1	*Units*	1 & 2	
Class/Sem	6thSem	*Date*		*CL*	R/U/A/AN/E	
Course Name	Advanced Microprocessors	*Time*		*COs*	1 & 2	
Course Code	15EC63B	*Max. Marks*	20	*POs*	3	
Note to students: Answer all questions						

No.	Question	Marks	CL	CO	PO
1	List the features of 8086 ***OR*** Sketch & Explain how physical address is calculated in 8086	05	R/A	1	1,2,10
2	Explain the PIN functions of 8086 in minimum mode	05	U	1	1,2,10
3	List the classification of instruction set of 8086 with example ***OR*** Choose CS=3000H, DS=0000H, SS=2000H, BP=0123H, BX=0005H, SI=0500H. Calculate the memory address the following instructions will access. Also explain the addressing modes that are used by each instruction. i. MOV CX, [1234H] ii. MOV DX, [BP] iii. MOV DX, [BX + SI + 200H]	05	R/E	2	1,2,10
4	Explain the role of index and pointer Registers	05	U	2	1,2,10

Semester End-Exam Evaluation (SEE)

(i) End-exam question-paper pattern

Unit No.	Unit Name	Study Duration (Hrs.)	No. Questions for End-exam	
			5 marks Part - a	10 marks Part - b
1	Architecture of 8086 microprocessor	8	2	2
2	8086 Instruction set	10	2	2
3	8086 Programming	10	1	2
4	Interrupts and Peripheral ICs	9	2	1
5	Advanced Microprocessors	10	2	2
6	Bus Standards	5	--	1
	Total	**52**	**09 (45 Marks)**	**10 (100 Marks)**

(ii) Model question paper

Course Title : **Advanced Microprocessors**
Course Code : **15EC63B** Time : **3 Hrs**
Semester : **Sixth** Max. Marks: **100**
Instructions: *1. Answer any **SIX** question from **Part A** (5x6=30 Marks)*
*2. Answer any **SEVEN** full questions from **Part B** (7x10=70 Marks)*

Part A

1. List the features of 8086.
2. Choose CS=1000H, DS=2000H, SS=3000H, ES=4000H, BP=0010H, BX=0020H, SP=0030H, SI=0040H, DI=0050H .find physical address for the following instructions

   MOV AL,[BP] MOV CX,[BX]
   MOV AL,[BP+SI] MOV CS:[BX],AL
3. List various logical instructions of 8086 microprocessor
4. Illustrate segment override pre-fix with an example
5. Define ASSEMBLER, LINKER, LOADER,EDITOR
6. List the features of 8251
7. Write a note on BIOS interrupts
8. List the features of 80286
9. Write a note on USB port

Part B

1. Explain the Internal Architecture of 8086
2. a)Explain the functions of ALE, BHE/s7, DT/R pins (5)
   b) Predict the value of IP, CS, PSW, ES, and SS registers of 8086 after reset(5)
3. Explain the following instructions with an example
   AAD ROR SUB XLAT REPNE
4. a) Choose CS=3000H, DS=0000H, SS=2000H, BP=0123H, BX=0005H, DI=0034H, SI=0500H Calculate the memory address the following instructions will access. Also explain the addressing modes that are used by each instruction. (5)
   a. MOV DX, [BP+DI]
   b. MOV DX, [BP + SI + 200H]
   c. MOV CS:[DI],AL

   b) Write 8086 assembly language instructions which perform following operations(5)
   i) Copy a word from port 95H to AX
   ii) Add 1 to contents of BX
   iii) Convert signed byte in AL to signed word in AX
   iv) Load the number F3H into AL register.
   v) Shift word stored in AX right 5 times
5. a) Write a program to convert packed BCD to unpacked BCD(5)
   b) Write a program to find largest number in a given array(5)
6. Explain the following directives:
   MODEL DB PUBLIC PTR ASSUME
7. a) Explain the sequence of actions performed upon interrupt request(5)

b) Write the contents of IP register in 8086 IVT for the following (5)
i) Divide-by-zero ii) Single step iii) NMI iv) Break point v) Overflow

8. Sketch and Explain the Block diagram of Advanced Microprocessor
9. a)Explain memory hierarchy in advanced microprocessor (6)
   b) Explain the need of bus standard.(4)
10. Explain the block diagram of PowerPC601

Model Question Bank

Course Title : **Advanced Microprocessors**	Course Code: **15EC63B**

(The following Questions are only indicative, Faculty can frame their own question based on the OBE guidelines)

UNIT-1 Architecture of 8086 microprocessor
05 Marks

Remember

1. List the features of 8086.
2. Define minimum mode. Name all minimum mode pins of 8086 microprocessor
3. Define maximum mode. Name all maximum mode pins of 8086 microprocessor
4. List the internal registers in 8086 microprocessor and their abbreviations and lengths.
5. List the uses of segment registers in 8086.

Understand

1. Explain the pin functions of 8086 in minimum mode.
2. Explain the pin functions of 8086 in maximum mode.
3. Compare minimum mode and Maximum mode of 8086 microprocessor
4. Describe the functions of index registers.
5. Explain the concept of segmented memory. What are its advantages?
6. Explain general purpose registers of 8086 microprocessor
7. Explain segment registers of 8086
8. Explain the need of segmentation
9. Describe the function of status lines S0,S1 and S2 of 8086 microprocessor
10. Explain the functions of ALE, BHE/s7, DT/R pins
11. Explain control flags of 8086
12. Explain status flags of 8086
13. Explain physical memory organization of 8086 microprocessor
14. Explain how address-data bus is de-multiplexed in 8086?
15. Explain Bus Interface Unit of 8086 microprocessor
16. Explain Execution Unit of 8086 microprocessor

Application

1. Sketch & Explain how physical address is calculated in 8086
2. Write the pin diagram of 8086 microprocessor
3. Write interfacing diagram of 8086 with memory and I/O devices under minimum mode configuration.

4. Sketch the internal diagram 8086.

Analyse

1. Illustrate how 20-bit physical address is generated in 8086 with an example
2. Calculate the physical addresses represented by
   i. 1234H: 0002H
   ii. 2670H: 2222H
   iii. F2F2H: 1234H
3. Calculate the physical address if the contents of
   i. CS=384AH , IP=4214H
   ii. DS=1000H, SI=2500H
4. Illustrate how Instruction queue is implemented in 8086

Evaluate

1. Choose CS=1000H,DS=2000H,SS=3000H,ES=4000H,BP=0010H,BX=0020H,SP=0030H,SI =0040H,DI=0050H .find physical address for the following instructions

   MOV AL,[BP] MOV CX,[BX]

   MOV AL,[BP+SI] MOV CS:[BX],AL
2. Predict the value of IP, CS, PSW, ES, and SS registers of 8086 after reset.
3. Predict the contents of all status flags after the execution the following instructions

   MOV AX, 65D1H
   MOV DX, 2359H
   ADD AX, BX

10 Marks

Understand

1. Explain the Internal Architecture of 8086
2. Explain the FLAG register of 8086
3. a)Explain the functions of QS1 and QS0 pins of 8086
   b) Describe the functions of index and pointer registers.
4. a) Explain with example how 16 bit address is converted into 20 bit address.
   b) Explain the functions of DMA lines.
5. Explain the programming model of 8086.
6. Explain the functions of TEST, BHE, READY, RESET, LOCK pins of 8086.

Application

1. Write the pin diagram of 8086 and explain the pins
2. Interface the I/O devices to 8086 in minimum mode.
3. Write interfacing diagram of 8086 with memory and I/O devices under minimum mode configuration

UNIT-2: 8086 Instruction set

05 Marks

Remember

1. Define addressing mode. explain any three Addressing modes
2. List the classification of instruction set of 8086 with example.
3. Differentiate between the jump and loop instructions.
4. List various arithmetic instructions of 8086 microprocessor?
5. List various data transfer instructions of 8086 microprocessor?

6. List various string related instructions of 8086 microprocessor?
7. List various logical instructions of 8086 microprocessor

Understand

1. Explain the following instructions i) IMUL, ii) MUL
2. Explain the programming model of 8086.
3. Explain the following instructions i) AAA, ii) AAD
4. Explain the role of index and pointer Registers.
5. Explain the difference between the respective shifts and rotate instructions.
6. Explain repeat instructions with example
7. Explain CALL and RET instructions
8. Describe the difference between a jump and a call instruction

Analyse

1. Illustrate any 3 addressing modes with an example
2. Identify the addressing mode is used the following instructions
   i. MOV AX, BX
   ii. MOV AX, [DI]
   iii. IN AX,DX
   iv. MOV CX, 2342H
   v. ADD AX,[BX][BP]
3. Illustrate segment override pre-fix with an example.
4. Differentiate between LOOP and REP instructions.
5. Differentiate between intra-segment and intra-segment jump instruction

Evaluate

1. Choose AL = 99H and BL = 47H after DIV BL what are the values of AL and AH.
2. Choose AX = 200H and CX = 6H after MUL CX what are the values of AX and DX
3. Choose CS=3000H, DS=0000H, SS=2000H, BP=0123H, BX=0005H, SI=0500H. Calculate the memory address the following instructions will access. Also explain the addressing modes that are used by each instruction.
   a. MOV CX, [1234H]
   b. MOV DX, [BP]
   c. MOV DX, [BX + SI + 200H]
6. Choose CS=3000H, DS=0000H, SS=2000H, BP=0123H, BX=0005H, DI=0034H, SI=0500H Calculate the memory address the following instructions will access. Also explain the addressing modes that are used by each instruction.
   d. MOV DX, [BP+DI]
   e. MOV DX, [BP + SI + 200H]
   f. MOV CS:[DI],AL

Create

1. Write 8086 assembly language instructions which perform following operations
   vi) Copy a word from port 95H to AX
   vii) Add 1 to contents of BX
   viii) Convert signed byte in AL to signed word in AX
   ix) Load the number F3H into AL register.
   x) Shift word stored in AX right 5 times

2. Write the condition for jump after the execution of the following instructions
   JC REPNE JA JB LOOPE

10 Marks

Understand

1. Explain the role of IP, BP, SP, SI, DI register.
2. Explain the string instructions with an example
3. a) Explain the functions of machine control instructions.
   b) Differentiate between RET and IRET
4. Explain the following instructions with an example
   AAD ROR SUB XLAT REPNE
5. Explain the following instructions with an example
   DAS MOV SHR LODSB XOR
6. Explain with examples the addressing of I/O ports and based indexed addressing mode.
7. Explain the following addressing mode of 8086 with example
   i) Based ii) implicit iii) direct iv) register v) indirect

UNIT-3 8086 Programming

05 Marks

Remember

1. Define ASSEMBLER, LINKER, LOADER,EDITOR
2. Define PROCEDURE and MACRO.
3. Define assembler directive? Explain any 3 with suitable example.

Understand

1. Differentiate between PROCEDURE and MACRO.
2. Explain the process of assembling.
3. Explain the process of Linking.
4. Explain the structure of assembly program
5. Explain alignment directives
6. Explain value returning attribute directives
7. Explain data control directives
8. Explain the following directives
   i) ORG ii) TYPE iii) DW iv) ENDS v) ASSUME
9. Explain the following directives
   i) SHORT ii) OFFSET iii) ALIGN iv) ENDM v) EQU
10. Describe the need of the following program development tools in 8086.
    Assembler Editor Linker

Application

1. Write an ALP to add two 16-bit numbers.
2. Write an ALP to multiply 8-bit numbers.
3. Write a program to move a block of data from memory location 0300H to 0400H
4. Write a program to find largest number in a given array.
5. Write a program to search a given number in an array of numbers.
6. Write a program to convert decimal to hexadecimal.

7. Write a program to convert packed BCD to unpacked BCD.
8. Write a program to add an array of 16-bit numbers.

10 Marks

Understand

1. Explain the following directives:

   MODEL DB PUBLIC PTR ASSUME

Application

1. Write an ALP to display String on the console.
2. Write a program to separate out positive and negative numbers from a given series of 16-bit hexadecimal numbers.
3. Write a program to find that given string is palindrome or not.
4. Write a program to sort a given number of bytes in ascending order.

UNIT-04: Interrupts and Peripheral ICs

05 Marks

Remember

1. Define interrupt, interrupt service routine and vector table.
2. Define interrupt. List various types of interrupts
3. List the modes of operation of 8253 Interval timer.
4. List the features of 8087 numeric co-processor
5. List all interrupt vectors.
6. List the features of 8255.
7. List the features of 8253.
8. List the features of 8259.
9. List the features of 8251.
10. List the features of 8257.
11. List the Differences between DOS & BIOS interrupts.

Understand

1. Explain the sequence of actions performed upon interrupt request.
2. Describe hardware and software interrupts.
3. Explain the operating modes of 8255

Application

1. Sketch IVT and explain
2. Write a note on BIOS interrupts
3. Write a note o n DOS interrupts

Analyse

1. Justify which interrupts are allocated in IVT for the following address of the IP register
   i) 0000H ii) 0004H iii) 0008H iv) 000CH v) 0010H
2. Write the contents of IP register in 8086 IVT for the following
   i) Divide-by-zero ii) Single step iii) NMI iv) Break point v) Overflow

10 Marks

Application

1. a) Sketch and explain the block diagram of 8255 PPI. (8)
   b) Differentiate between maskable and non- maskable interrupts(2)

UNIT-5 Advanced Microprocessors and Bus Standards

05 Marks

Remember

1. Define pipeline, SFU, virtual memory, superscalar issue of instructions, cache.
2. List the features of 80286
3. List the features of DUAL CORE PROCESSOR.
4. List the features of 80486.
5. List the features of PENTIUM PROCESSOR
6. List the functions of MMU.
7. List the features of 80386 microprocessor
8. List the features of Pentium IV microprocessor?
9. List the features of SATA bus.
10. List the features of USB?
11. List the features of Parallel centronic bus
12. List the features of I^2C bus?
13. List the differences between 80486 and Pentium processor

Understand

1. Compare 80286 with 80386.
2. Explain the need of bus standard.
3. Explain the different types of pipeline hazards.
4. Compare serial and parallel buses.

Application

1. Sketch and Explain the Block Diagram Bus Interface Unit
2. Sketch and Explain the Block Diagram Integer Unit
3. Sketch and Explain the Block Diagram Floating Point Unit
4. Sketch and Explain the Block Diagram Memory Management Unit
5. Write a note on Cache memory
6. How to convert virtual to physical address
7. Write a note on USB port.

10 Marks

Understand

1. a)Explain memory hierarchy in advanced microprocessor (6)
b) Explain superscalar issue of instructions (4)

Application

1. Sketch and Explain the Block diagram of Advanced Microprocessor.

UNIT-6 Other Advanced Microprocessors

05 Marks

Remember

1. List the features of PowerPC601.
2. List the features of SuperSPARC Processor.

10 Marks

Understand

1. Explain the block diagram of PowerPC601.

End

Government of Karnataka

Department of Technical Education
Board of Technical Examinations, Bengaluru

Course Title:**Object Oriented Programming Using C++**		Course Code	: **15EC63C**
Credits	: **4**	Semester	: **6**
Teaching Scheme in Hrs (L:T:P)	: **4:0:0**	Course Group	: **Elective**
Type of course	: **Lecture**	Total Contact Hours	: **52**
CIE	: **25 Marks**	SEE	: **100 Marks**

Prerequisites

Knowledge of programming and C language.

Course Objectives

1. To understand the need for high-level languages including C++ and programming paradigms.
2. To understand the syntax of C++ and writing simple programs in C++
3. To understand the need and role of object oriented programming for real-world applications.
4. To enable the students to write simple programs using OOP concepts

Course Outcomes

On successful completion of the course, the students will be able to

1. Understand the C++ language features.
2. Use the control structure and data types in C++.
3. Write simple programs using classes and objects.
4. Write simple programs to implement overloading concepts.
5. Understand the concepts of inheritance and polymorphism.
6. Understand virtual functions and I/O statements.

Course Outcome		CL	Linked POs	Teaching Hours
CO1	Understand the C++ language features.	***R/U/C***	1,2,4,10	09
CO2	Use the control structure and data types in C++.	***R/U/A***	1,2,4,10	10
CO3	Write simple programs using classes and objects.	***R/U/A***	1,2,4,10	09
CO4	Write simple programs to implement overloading concepts.	***U/A/C***	1,2,4,10	08
CO5	Understand the concepts of inheritance and polymorphism.	***U/A/C***	1,2,4,10	07
CO6	Understand pointers, virtual functions and I/O statements.	***U/A***	1,2,10	09
			Total Sessions	**52**

Legends: PO-Program Outcome, CO-Course Outcome, CL-Cognitive Level, R-Remember, U-Understand, A-Apply, C-Create

Mapping Course Outcomes with Program Outcomes

Course Outcomes	Programme Outcomes									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	*	*	--	*	--	--	--	--	--	*
CO2	*	*	--	*	--	--	--	--	--	*
CO3	*	*	--	*	--	--	--	--	--	*
CO4	*	*	--	*	--	--	--	--	--	*
CO5	*	*	--	*	--	--	--	--	--	*
CO6	*	*	--	---	--	--	--	--	--	*

***Legend**: * Linked, -- No link*

Course-PO attainment matrix

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
Object Oriented Programming using C++	**3**	**3**	**--**	**3**	**--**	**--**	**--**	**--**	**--**	**3**

***Legend**: Addressing levels: 1-Slight, 2-Moderate, 3-Substantial, -- Not addressed*

***Quantification Method:** This is to relate the level of PO with the number of hours devoted to the COs which address the given PO. If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3; if 25 to 40% , Level 2; if 5 to 25%, Level 1; and if < 5%, not addressed.*

Course content and pattern of marks for SEE

Unit	Unit Name	Teaching Hours	Weightage for CLs in SEE			Marks	Weightage (%)
			R	U	A		
1	Introduction to OOP and C++	**9**	05	10	10	25	12
2	Control structure and data types.	**10**	05	05	10	20	14
3	Classes and objects.	**09**	05	10	10	25	25
4	Overloading.	**08**	05	10	10	25	15
5	Inheritance, polymorphism.	**07**	05	05	15	25	15
6	Pointers, Virtual functions, console I/O statements.	**09**	05	05	15	25	19
	Total	**52**	**30**	**45**	**70**	**145**	**100**

Legend: R- Remember, U-Understand A-Application

Course Contents

Unit – 1: Introduction to OOP and C++ **Duration: 09 Hrs.**

Features of C language, POP and OOP. List of OOP languages. Basic format of C++ program. Processor Directives. I/O statements. Language syntax: Keywords, identifiers, constants, variables, classification of variables based on scope and life, operators. Data types: Basic, derived and user-defined data types. Data-type casting. Data abstraction and encapsulation. Simple example programs.

Unit – 2: Control Structure and Data Types **Duration: 10 Hrs.**

Concepts of control structure. Branching- if, if-else, switch, break, continue. Looping-for, while anddo-while. Derived data type: Arrays, strings, pointers, enumerated data types and functions. Functions-Call by value, address and reference. User-defined data type: structure, union and classes. Example programs.

Unit – 3: Classes and Objects **Duration: 09 Hrs.**

Introduction to class and objects. Limitation of Structure and benefits of class. Class and object creation. Private and public, protected members of class-Variables, arrays and functions. Accessing Class Members. Memory allocation for Objects. Array of objects. Friend Function. Data abstraction and data encapsulation. Simple example programs.

Unit-4: Overloading **Duration: 08 Hrs.**

Introduction to overloading. Constructors: parameterized constructors, default arguments, overloading and copy constructor. Destructors, Unary and binary operator overloading. Function overloading, functions with default arguments. Inline functions. Simple example programs.

Unit-5:InheritanceandPolymorphism **Duration: 07 Hrs.**

Introduction to inheritance. Defining derived classes, Levels of inheritance, Single inheritance, public and private member inheritance, multiple inheritance, Hierarchical inheritance, Hybrid inheritance, polymorphism. Example programs.

Unit-6: Pointers, Virtual Functions, Console I/O Statements **Duration: 09 Hrs.**

Pointers-Declaration and initialization. Manipulation of pointers, pointers to objects, pointers to derived classes, pointers with arrays and strings. Introduction to Virtual functions, rules for virtual functions, pure virtual functions. Formatted and Unformatted I/O functions. Simple example programs. Features of other OOPS languages-JAVA and PYTHON.

References

1. Object oriented programming with C++--Rabertlafer
2. Object oriented programming with C++-- 4E, E Balaguruswamy, Tata McGraw hill
3. OOPS with C++ By Niranjan A.,Sapna Publications
4. Object oriented programming in C++, By P B Kottur.,Sapna Publications

5. Object oriented programming in C++, Dr.G.T. Thampi, Dr. S.s.Matha,Dreamtech, 2009 edition,
6. Object oriented programming in C++, Rajesh K Shukla ,Wiely Precise text Book.2008.
7. Object Oriented Programming with C++ , SouravSahay, Oxford Higher Education
8. Analysis & Designing Of Algorithms with C/C++ -By Nandagopalan.
9. C++ Complete Reference, Herbert Schilt. TMH.
10. Programming in C++ , M T Somashekar , PHI
11. Professional C++ , Wiley India (Wrox)

Course Delivery

The course will be delivered through lectures, presentations and support of modern tools. Student activities are off-class.

Course Assessment and Evaluation Scheme

Master Scheme

Assessment Method	What		To Whom	Assessment mode /Frequency /timing	Max. Marks	Evidence Collected	Course Outcomes
Direct assessment	CIE	IA	Students	Three tests+	**20**	Blue Books	1 to 6
				Activity*	**05**	Activity Sheets	1 to 6
	SEE	End exam		End of the course	**100**	Answer Scripts at BTE	1 to 6
				Total	**125**		
Indirect assessment	Student feedback on course		Students	Middle of the Course	Nil	Feedback Forms	1 to 3 Delivery of course
	End of course survey			End of the Course	Nil	Question-naires	1 to 6 Effectiveness of delivery instructions & assessment methods

Legends: CIE-Continuous Internal Evaluation, SEE- Semester End-exam Evaluation

+ Every I.A. test shall be conducted for 20 marks. Average of three tests, by rounding off any fractional part thereof to next higher integer, shall be considered for IA.

***S**tudents should do activity as per the list of suggested activities/ similar activities with prior approval of the teacher. Activity process must be initiated well in advance so that it can be completed well before the end of the term and assessed through appropriate Rubrics.

Questions for CIE and SEE will be designed to evaluate the various CLs as per the Weightage shown in the following table.

Sl. No.	Cognitive Levels (CL)	Weightage (%)
1	Remembering	15
2	Understanding	30
3	Applying	40

4	Evaluate	10
5	Create	05
	Total	**100**

Continuous Internal Evaluation (CIE) pattern

(i) Student Activity (5 marks)

The following student activities or similar activities can be assigned for assessing CIE/IA marks

Sl. No.	Activity
1	Execute and submit at least two simple programs from each of unit1, unit2 and unit3
2.	Execute and submit at least two programs from each of unit4, unit5 and unit6.

Execution Mode

1. Activity 1 and 2 are mandatory for every batch; every batch can have maximum of 4 students.
2. Activities shall be carried out batch-wise throughout the semester and submit one report per batch before the end of the semester.
3. Report shall be qualitative and not to exceed 6 pages.
4. Each of the activity can be carried out off-class; however, demonstration/presentation should be done in the Lab/class room.
5. Teacher is expected to observe and record the progress of students' activities
6. Assessment shall be in accordance with the following **rubrics** table.

Institutional activities (No marks)

The following are suggested institutional activities, to be carried out at least one during the semester. The course teacher/coordinator is expected to maintain the relevant record (Containing, Activity name, Resource persons and their details, duration, venue, student feedback, etc) pertaining to Institutional activities.

Sl. No.	Activity
1	Practice some programs related to topics of the course in the Lab.
2	Arrangement of a talk/seminar/lecture on OOP languages

(ii) Model of rubrics for assessing student activity (for every student)

Dimension	Scale					Marks (Example)
	1 Unsatisfactory	2 Developing	3 Satisfactory	4 Good	5 Exemplary	
1. Research and gathering information	Does not collect information relate to topic	Collects very limited information, some relate to topic	Collects basic information, most refer to the topic	Collects more information, most refer to the topic	Collects a great deals of information, all refer to the topic	3
2. Full-fills team roles and duties	Does not perform any duties assigned to the team role	Performs very little duties	Performs nearly all duties	Performs almost all duties	Performs all duties of assigned team roles	2
3. Shares work	Always relies on others to do	Rarely does the assigned	Usually does the	Always does the assigned	Always does the assigned	5

equality	the work	work, often needs reminding	assigned work, rarely needs reminding	work, rarely needs reminding.	work, without needing reminding	
4. Listen to other team mates	Is always talking, never allows anyone to else to speak	Usually does most of the talking, rarely allows others to speak	Listens, but sometimes talk too much,	Listens and talks a little more than needed.	Listens and talks a fare amount	3
					Total marks	ceil(13/4)= 4

(iii) CIE/IA Tests (20 Marks)

Three tests have to be conducted in accordance with the test pattern given below and average marks of them are considered for CIE/IA with specified schedule. Fractional average marks can be rounded-off to next higher integer.

(iv) Format of CIE/IA test question paper

CIE Question Paper								
Institution Name and Code								
Course Coordinator/Teacher								
Program Name		***Test No.***		*Units*				
Class/Sem		*Date*		*CL*				
Course Name		*Time*		*COs*				
Course Code		*Max. Marks*		*POs*				
Note to students: Answer all questions								
Question No.	**Question**			Marks	**CL**	**CO**	**PO**	
1								
2								
3								
4								

Legends: PO-Program Outcome, CO-Course outcome, CL-Cognitive Level, R-Remember, U-Understand, A-Apply

Note: Internal choice may be given in each CO at the same cognitive level (CL).

(v) Model question paper for CIE

CIE Question Paper					
Institution Name and Code					
Course Coordinator/Teacher					
Program Name	Electronics and Communication	***Test No.***	1	*Units*	1 & 2
Class/Sem	5TH Sem	*Date*	1/1/2017	*CL*	R/U/A
Course Name	Object Oriented Programming using C++.	*Time*	10-11AM	*COs*	1 & 2
Course Code	15EC54B	*Max. Marks*	20	*POs*	1, 2 & 3

Note to students: Answer all questions

No.	**Question**	Marks	**CL**	**CO**	**PO**
1	List features of object Oriented Programming OR Identify Keywords, Tokens.	05	U/A	1	1,2,3
2	Classify variables based on Scope and life time	05	A	1	1,2
3	Describe if-else with syntax and example. OR Express Conditional statements With Syntax.	05	U	2	1,2

4	Describe Declaration and Initialization of one dimensional array with syntax and Example	05	A	2	1,2

Semester End-exam Evaluation (SEE)

(i) End-exam question-paper pattern

Unit	Unit Name	Study Duration (Hrs.)	No. Questions for end-exam	
			PART – A 5 Marks	PART – B 10 Marks
1	Introduction to OOP and C++	9	02	01
2	Control structure and data types .	10	01	02
3	Classes and objects.	09	02	02
4	Overloading.	08	01	02
5	Inheritance, polymorphism	07	02	01
6	Pointers, Virtual functions, console I/O statements.	08	01	02
	Total	**52**	**09 (45 Marks)**	**10 (100 Marks)**

(ii) Model question paper

Course Title **: Object Oriented Programming using C++**
Course Code **: 15EC54B** Time **: 3 Hrs**
Semester **: Fifth** Max. Marks**: 100**
Instructions*: 1. Answer any **SIX** question from **Part A** (5x6=30 Marks)*
*2. Answer any **SEVEN** full questions from **Part B** (7x10=70 Marks)*

Part A

1. List the features of Object Oriented Programming.
2. Explain processor Directives in C++.
3. Differentiate while and do-while.
4. Demonstrate creating a Classes and objects
5. Express Friend functions Friend Class.
6. Summarize Rules for operator overloading
7. Illustrate polymorphism means in C++.
8. Discuss Hierarchical inheritance.
9. Discuss the need of Virtual function.

Part B

1. Explain built-in data types and Derived data types.
2. Describe Declaration and Initialization of two dimensional arrays with syntax and Example.
3. Explain String handling functions.
4. Compute accessing Class Members.
5. Differentiate between private, public and protected.
6. Illustrate Function overloading.
7. Compute some Example programs related to overloading.
8. Explain public and private member inheritance.

9. Describe Class Templates, Class Templates with multiple parameters
10. Demonstrate to make Virtual function "Pure". Explain implications making a function a pure virtual function.

Model Question Bank

Note: The questions in the question bank are indicative but not exhaustive. Sub-questions on different CLs may be combined in 10-marks questions or 10-marks questions can be spitted into if necessary keeping Weightage of CLs approximately intact.

Unit-1Introduction to OOP and C++

5-Mark questions

Remember

1. Describe object oriented programming.
2. List advantages of object oriented programming.
3. List features of Procedure Oriented Programming.
4. List features of object Oriented Programming.
5. Identify Keywords, Tokens.
6. Tabulate different types of Constants.

Understand

1. Discuss Identifiers and their naming rules.
2. Illustrate variables Declaration and Initialization procedure.
3. Discuss Data types.
4. Explain processor Directives.
5. Differentiate between object oriented programming and procedure oriented programming.

Application

6. Write a program to read two numbers from the keyword and display large no. on the screen.
7. Write a program to read the values of a, b and c and display the value of x, where x=a/b-c. Assume some values for a, b, c.
8. Write a program calculates the area of a rectangle and displays it.

10-Mark questions

Understand

1. Explain basic structure of C++ program with Examples.
2. Summarize I/O statements with syntax and Examples.
3. Classify variables based on Scope and life time.
4. Discuss Arrays and Strings with syntax and Examples.
5. Explain built-in data types and Derived data types.
6. Explain Operators in C++.

Create

7. Write a program to display the following output using a single **cout** statement.

   Maths = 90
   Physics = 77
   Chemistry = 69

Unit-2 Control structure and data types

5-Mark questions

Remember

1. List different types of control structures.
2. Describe if, if-else with syntax and example
3. Define break, continue with syntax and example.

Understand

1. Represent switch statement with syntax and example.
2. Express Conditional statements With Syntax.
3. Classify array with syntax.
4. Differentiate while and do-while.
5. Differentiate C and C++.

Application

6. Write a program to display a string entered by user.
7. Write a Program to illustrate Returning structure from function in C++.

10-Mark questions

Understand

1. Explain for, while, do-while loop control structure with syntax.
2. Describe Declaration and Initialization of one dimensional array with syntax and Example.
3. Describe Declaration and Initialization of two dimensional array with syntax and Example.
4. Compute program for 'for' loop with respect to C++.
5. Compute program for addition of diagonal elements of matrix with C++ statements.
6. Explain String handling functions.

Create

7. Write a program to display marks of 5 students by passing one- dimensional array to a function.
8. Write a program to display the following output using **for** loops

   1
   22
   333
   4444
   ……..
9. Write a program to evaluate the following function to 0.0001% accuracy
   $Cosx = 1-x^2/2! +x^4/4! -x^6/6! +$…….
10. Write a program to Calculate the variance and standard deviation of N numbers.
11. Write a program to illustrate elements of two dimensional array by passing it to a function.
12. Write a C++ program to define enumeration type and assign value to variable of that type.

Unit-3Classes and Objects

5-Mark questions

Remember

1. Define Class and objects.
2. Describe specifying Class.
3. Describe procedure for creating a Classes and objects

Understand

1. Discuss limitation of Structure.
2. Discuss instantiation of objects?
3. Distinguish between Object and Class.
4. Experiment with some examples of Classes
5. Report with the help of suitable example how data abstraction and data encapsulation takes place.
6. Explain Friend functions and Friend Class.

10-Mark questions

Understand

1. Relate Declaration of arrays and function with respect to class and objects.
2. Compute accessing Class Members.

3. Differentiate between private, public and protected.
4. Discuss Memory allocation for Objects.
5. Indicate array of objects.

Create

6. Write a Program to illustrate working of Objects and Class in C++ Programming.
7. Define a class to represent a bank account. Include the following members
   Data members
   1. Name of the depositor. 2. Account Number
   3. Type of account. 4. Balance amount in account.
   Member functions
   1.To assign initial values
   2. To deposit an amount
   3. To withdraw an amount after checking the balance
   4. To display name and balance.
   Write a program to test the program.

Unit-4 Overloading

5-Mark questions

Understand

1. Establish Constructors and Destructors.
2. Represent Parameterized constructors.
3. Describe Constructor overloading.
4. Report Constructors with default arguments.
5. Explain Copy constructor with syntax.
6. Summarize Rules for operator overloading.

10-Mark questions

Understand

1. Describe Operator overloading -- unary and Binary operators
2. Illustrate Function overloading.
3. Describe functions with default arguments.
4. Discuss Inline functions.

Create

5. Compute some Example programs related to overloading.
6. Write a program to return absolute value of variable types integer and float using function overloading.
7. Write a program to add two complex numbers by passing objects to function.
8. Write a program demonstrate the working of overloaded constructors.

Unit-5Inheritance, Polymorphism

5-Mark questions

Remember

1. Define inheritance.
2. Describe derived classes.

Understand

3. Discuss syntax for Single inheritance.
4. Discover to use protected visibility specifies to class members.
5. Discuss Hierarchical inheritance.
6. Describe how an object of a class that contains object of other classes created.
7. Explain Hybrid inheritance.
8. Illustrate polymorphism means in C++.

9. Differentiate B/W inheritance and polymorphism.

10-Mark questions

Understand

1. Describe different form of inherence with Example
2. Explain multiple inheritances. When do we use such an inheritances.
3. Explain public and private member inheritance.
4. Develop some example programs related to classes and objects.
5. Summarize levels of inheritance.

Create

6. Write a program to demonstrate the multilevel inheritance.
7. C++ program to calculate the area and perimeter of rectangles using concept of inheritance.

Unit-6 Pointers, Virtual functions, console I/O statements

5-Mark questions

Remember

1. Describe pointers with syntax.
2. Discuss how procedure makes class virtual.
3. Define Virtual functions.
4. List rules for Virtual functions.
5. List the features of JAVA.
6. List the features of PYTHON.
7. List the features OF C#.

Understand

8. State Pure virtual functions with example.
9. Discuss the need of Virtual function

10-Mark questions

Understand

1. Explain declaration and initialization of pointers with syntax.
2. Explain pointer with arrays with example.
3. Explain how to implement pointers into the objects.
4. Discuss Formatted and Unformatted I/O functions.
5. Describe to make Virtual function “Pure”. Explain implications making a function a pure virtual function.
6. Recognize the need of Virtual function.

End

Government of Karnataka

Department of Technical Education
Board of Technical Examinations, Bengaluru

Course Title:**Industrial Automation Lab**		Course Code	: **15EC64P**
Semester	: **6**	Course Group	: **Core**
Teaching Scheme in Hrs (L:T:P)	: **0:2:4**	Credits	: **3**
Type of course	: **Tutorial + Practical**	Total Contact Hours	: **78**
CIE	: **25 Marks**	SEE	: **50 Marks**

Prerequisites

Knowledge of electronic devices and logic systems

Course Objectives

1. Compare the semiconductor devices with power electronics devices.
2. Applications of power control devices
3. Design and simulate PLC circuits

Course Outcomes

On completion of the course student should able to.

1. Design and analyse the working of MOSFET, IGBT, SCR controlled rectifier circuits using R-C triggering circuit.
2. Demonstrate the functionality of Thyristor circuits such as light dimmer circuit, UJT relaxation oscillator, and voltage commutated chopper.
3. Illustrate the speed control of motors and sequential timer using IC 555.
4. Understand and analyse Ladder diagram concept to test digital logic gates, Boolean expression, Demorgan's theorem.
5. Illustrate the Ladder program for DOL starter, Stair case light, Water level controller, Conveyer control, and Lift control applications.
6. Analyse and implement any Simple industrial electronics circuit, PLC programming.

Course Outcome		CL	Linked Experiments	Linked PO	Teaching Hrs
CO1	Design and analyze the working of MOSFET, IGBT, SCR controlled rectifier circuits using R-C triggering circuit.	***R/U/A***	Unit-1: Part-A: E:1 to 2	1,2,3,4, 10	12
CO2	Demonstrate the functionality of Thyristor circuits such as light dimmer circuit, UJT relaxation oscillator, and voltage commutated chopper.	***U/A***	Unit-1: Part-A: E:3 to 5	1,2,3,4, 10	09
CO3	Illustrate the speed control of motors and sequential timer using IC 555.	***U/A***	Unit-1:Part A: E:6 to 9	1,2,3,4, 10	12
CO4	Understand and analyze Ladder diagram concept to test digital logic gates, Boolean expression, Demorgan's theorem	***R/U/A***	Unit-1: Part B: E:10 to 12	1,2,3,4, 10	12
CO5	Illustrate the Ladder program forDOL	***U/A/E***	Unit-1: Part B:	1,2,3,4,	21

	starter, Stair case light, Water level controller, Conveyer control, and Lift control applications.		E:13 to 18	10	
CO6	Analyze and implement any Simple industrial electronics circuit using PLC programming	***U/A/E/ C***	Unit-2	1,2,3,4, 5,8,9,10	06 (off-class)
				Two CIE/IA Tests	**06**
				Total sessions	**78**

Legend: R-Remember, U-Understand, A-Application, E-Evaluate, C-Create, CL-Cognitive Level, and PO-Program Outcome

Mapping Course Outcomes with Program Outcomes

Course Outcomes	Programme Outcomes									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	*	*	*	*	--	--	--	--	--	*
CO2	*	*	*	*	--	--	--	--	--	*
CO3	*	*	*	*	--	--	--	--	--	*
CO4	*	*	*	*	--	--	--	--	--	*
CO5	*	*	*	*	--	--	--	--	--	*
CO6	*	*	*	*	*	--	--	*	*	*

Course-PO Attainment Matrix

Course	Programme Outcomes									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Industrial Automation Lab	**3**	**3**	**3**	**3**	**1**	**--**	**--**	**1**	**1**	**3**

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3

If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2

If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1

If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not addressed.

Course Contents

Unit-1: Tutorials and Graded Exercises 72 Hours

Sl. No.	Topic/Exercises	Duration (Hr)

Part-A: Power electronics devices experiments		
1	Determination of holding current and break-over voltage of an SCR.	3
2	Full-wave controlled rectifier circuit using R-C triggering circuit	3
3	Light dimmer circuit using DIAC and TRIAC.	3
4	SCR triggering by UJT relaxation oscillator (Using Kit)	3
5	Voltage commutated chopper both constant frequency & variable frequency. (Using Kit)	3
6	Single phase to single phase cycloconverter (Using Kit)	3
7	Speed control of Universal motor. (Using Kit)	3
8	Speed control of stepper motor using inverter in clockwise & anti-clockwise direction. (Using Kit)	3
9	Sequential timer using IC 555.	3
10	Servicing/Maintenance of UPS (Only study experiments)	6

Part-B: PLC Programming experiments		
10	Study of PLC kit, practicing of basic programs.	3
11	Write the ladder diagram to test digital logic gates (two, three and four inputs)	6
12	Write the ladder diagram for three variable Boolean expressions and test the output. Example: $Y= \overline{(\bar{A}+B+C)+(BC)}$ and $Z=\overline{(\bar{A}B+C)}+\overline{(B+C)}$.	3
13	Write the ladder diagram to verify Demorgan's theorem.	3
14	Write the ladder diagram for DOL starter and test the output	3
15	Writing the ladder diagram and execute the Stair case light application	3
16	Writing the ladder diagram and execute the Water level controller application	3
17	Writing theladder diagram andexecute the Conveyer control application	3
18	Writing the ladder diagram and execute the Lift control application.	6
	Two Internal Assessment Tests(CIE)	6
	Total	**72**

Unit 2: Student Activities [CIE- 05 Marks] 6 Hours

Sl. No.	Activity	Duration (Hrs)
1	Visit and study the applications of Thyristors used in any nearby electrical power station.	06
2	Design the simple industrial electronics circuit/application by using any power semiconductor devices such as Thyristors, power diode, BJT, MOSFET etc.	
Execution Mode 1. At least 4 students per batch. Every batch is assigned any one of the activities. 2. Assessment shall be made based on quality of activity, presentation/demonstration and report as per rubrics.		

Institutional Activity (No marks)

The following are suggested institutional activities, to be carried out at least one activity during the semester. The course teacher/coordinator is expected to maintain the relevant record (Containing, Activity name, Resource persons and their details, duration, venue, student feedback, etc) pertaining to Institutional activities.

Sl. No.	Activity
1	Organize hands-on practice on design and implementation of Power electronic circuits, PLC and SCADA.
2	Organize a seminar/Guest lecture on Industrial applications of Thyristors.

References

1. Overview of Industrial Process Automation - KLS Sharma, Elsevier Publication
2. Power Electronics handbook, 3rd edition-Muhammad H. Rashid- Elsevier, ISBN: 978-0-12-382036-5
3. Programmable Logic Controllers- John W.Webb and Ronald A Reis (Principle and applications)(Fifth Edition).
4. Programmable Logic Controllers -Programming Methods and Applications, John R. Hackworth and Frederick D. Hackworth, Jr.
5. http://www.engineersgarage.com/articles/plc-programmable-logic-controller
6. https://en.wikipedia.org/wiki/Programmable_logic_controller
7. https://www.circuitlogix.com
8. www.electronicprojects.org/
9. http://www.asic-world.com/
10. http://www.electronics-tutorials
11. http://www.circuitstoday.com
12. http://www.allaboutcircuits.com
13. http://onlinemas.weebly.com/uploads/6/3/9/4/6394050/lab_manual_shafeeq.pdf
14. http://ezhil-ecesait.webs.com/Power-Electronics-Lab-Manual.pdf

Course Delivery

The course will be delivered through two-hour tutorials and four-hour hands-on practice per week. Tutorial shall be imparted before the conduction of the experiment. Student activities are off-class and presentation/report evaluation is during assigned lab sessions.

Course Assessment and Evaluation Scheme

Master Scheme

Assessment Method	What		To Whom	Assessment mode /Frequency /timing	Max. Marks	Evidence Collected	Course Outcomes
Direct assessment	CIE	IA	Students	Two tests+	10	Blue Books	1 to 6
				Record@	10	Record Book	1 to 6
				Activity*	05	Report/Sheets	1 to 6
	SEE	End exam		End of the course	50	Answer Scripts at BTE	1 to 6
				Total	75		
Indirect assessment	Student feedback on course		Students	Middle of the Course	Nil	Feedback Forms	1 to 3 Delivery of course
	End of course survey			End of the Course	Nil	Questionnaires	1 to 6 Effectiveness of delivery instructions & assessment methods

Legends: CIE-Continuous Internal Evaluation, SEE- Semester End-exam Evaluation

+ Every I.A. test shall be conducted as per SEE scheme of valuation. However, scored marks shall be scaled down to 10. Average of two tests, by rounding off any fractional part thereof to next higher integer, shall be considered for CIE/ IA.

***S**tudents should do activity as per the list of suggested activities/ similar activities with prior approval of the teacher. Activity process must be initiated well in advance so that it can be completed well before the end of the term.

@Record Writing: average of marks allotted for all experiments shall be considered; fractional part of the average shall be rounded-off to next higher integer.

Composition of CLs

Sl. No.	Cognitive Levels (CL)	Weightage (%)
1	Remembering	20
2	Understanding	30
3	Applying	40
4	Evaluate	05
5	Create	05
	Total	**100**

Continuous Internal Evaluation (CIE) pattern

(i) Student Activity (5 marks)

The student activities in Unit-2 or similar activities can be assigned

(ii) Model of rubrics for assessing student activity (for every student)

Dimension	Scale					Marks (Example)
	1 Unsatisfactory	2 Developing	3 Satisfactory	4 Good	5 Exemplary	
1. Information search and Collection.	Does not collect information relate to topic	Collects very limited information, some relate to topic	Collects basic information, most refer to the topic	Collects more information, most refer to the topic	Collects a great deals of information, all refer to the topic	3
2. Full-fills team roles and duties	Does not perform any duties assigned to the team role	Performs very little duties	Performs nearly all duties	Performs almost all duties	Performs all duties of assigned team roles	2
3. Shares work equality	Always relies on others to do the work	Rarely does the assigned work, often needs reminding	Usually does the assigned work, rarely needs reminding	Always does the assigned work, rarely needs reminding.	Always does the assigned work, without needing reminding	5
4. Listening Skills	Is always talking, never allows anyone to else to speak	Usually does most of the talking, rarely allows others to speak	Listens, but sometimes talk too much,	Listens and talks a little more than needed.	Listens and talks a fare amount	3
					Total marks	ceil(13/4)= 4

(iii) CIE/IA Tests (10 Marks)

Two tests have to be conducted in accordance SEE pattern and the marks shall be scaled down to 10. Average of two tests, rounding-off any fractional part to next higher integer, shall be considered for CIE/IA.

(iv) Record Evaluation (10 Marks)

Every experiment shall be assigned marks for a scale of 10 after its conduction based on student's performance and quality of write-up. Average of them, by rounding-off any fractional part to next higher integer, shall be considered for CIE/IA.

Semester End-exam Evaluation (SEE) Scheme

Sl. No.	Scheme	Max. Marks
1	**Part-A**: Writing circuit diagram of one experiment with Procedure /Tabular column/ Nature of graph/waveform, formula for calculations.	10
2	**Part-B**: Writing Ladder diagram and program of one experiment with procedure.	10
3	Conduction of Part-A experiment and result.	10
4	Execution of part-B experiment and result.	15
5	Viva-voce	05
TOTAL		**50**

Note:
1. Candidate is expected to submit the Lab record for the examination
2. Student shall not be allowed to conduct directly if he/she is unable to write at least one correct circuit diagram.

Laboratory Resource Requirements

Equipments and kits Requirement: For a batch of 20 students

Sl. No.	Equipment	Quantity
1	Industrial electronics Trainer kits	05 each
2	PLC Trainer Kit with the following modules: 1. DOL starter 2. Stair case light application. 3. Water level controller application 4. Conveyer control application 5. Lift control application.	05 each
3	Patch cards(different lengths)	100
4	Dual trace oscilloscope.	05
5	Digital multimeters	05
6	Tachometers	05

Model Questions for Practice and Semester End Examination

N**ote:** The questions in the question bank are indicative but not exhaustive.

Part-A

1. Determine holding current and break-over voltage of a given SCR experimentally.
2. Construct Light dimmer circuit using DIAC and TRIAC and verify the result.
3. Demonstrate Full wave controlled rectifier circuit using RC-triggering circuit.
4. Design Voltage commutated chopper both constant frequency & variable frequency.
5. Design the circuit of SCR trigged by UJT relaxation oscillator.
6. Verify the output for Single phase to single phase cycloconverter circuit .
7. Construct and verify the output for Speed control of Universal motor.
8. Construct and verify the output for Speed control of stepper motor using inverter in clockwise & anti-clockwise direction.
9. Construct the Sequential timer using IC-555 and verify the output.

Part-B

10. Write the ladder diagram to test digital logic gates (two, three and four inputs).
11. Write the ladder diagram for three variable Boolean expressions and test the output. Example: Y= $(\bar{A}+B+C)+(\overline{BC})$ and Z=$(\bar{A}B+C)+(\overline{B+C})$.
12. Write the ladder diagram to verify Demorgan's theorem.
13. Write the Ladder diagram for DOL starter and test the output.
14. Write the ladder diagram and execute the Stair case light application.
15. Write the ladder diagram and execute the Water level controller application.
16. Write the ladder diagram and execute the Conveyer control application.
17. Write the ladder diagram and execute the Lift control application.

End

Government of Karnataka
Department of Technical Education
Board of Technical Examinations, Bengaluru

Course Title :**Verilog Lab**		Course Code	: **15EC65P**
Semester	: **6**	Course Group	: **Core**
Teaching Scheme in Hr. (L:T:P)	: **0:2:4**	Credits	: **3**
Type of course	: **Tutorial + Practical**	Total Contact Hours	: **78**
CIE	: **25 Marks**	SEE	: **50 Marks**

Prerequisites

Knowledge of basic Mathematics, digital electronic circuits and Programming languages.

Course Objectives

Learn and understand the basics of Hardware description language and its use in designing electronic circuits.

Course Outcomes

At the end of the course, the students will be able to

1. Understand the basics of Hardware Description Languages, Program structure and basic language elements of Verilog.
2. Understand types of modelling, modules, functions of Verilog and simulate and synthesize related Programs.
3. Design, Simulate and synthesize various Verilog descriptions for Combinational circuits.
4. Design, Simulate and synthesize various Verilog descriptions for Sequential circuits.

Course Outcome		CL	Experiments linked	Linked PO	Teaching Hrs
CO1	Understand the basics of Hardware Description Languages, Program structure and basic language elements of Verilog.	***R/U/A***	Unit-1 Tutorial/practic e	1,2,3,4, 10	12
CO2	Understand types of modelling, modules, functions of Verilog and simulate and synthesize related Programs.	***R/U/A/ E***	Unit-1,Unit -2 E:1 to 2	1,2,3,4,5, 8,10	12+6=18
CO3	Design, Simulate and Synthesize various Verilog descriptions for Combinational circuits.	***U/A/E***	Unit -2, E:3 to 6	1,2,3,4,5, 8,10	15
CO4	Design, Simulate and Synthesize various Verilog descriptions for Sequential circuits.	***U/A/C***	Unit-2 E:7 to 11	1,2,3,4,5, 8,9,10	21
				Two CIE/IA Tests	06
				Student activity	06

Total sessions include two tests	**78**

Legend: R-Remember, U-Understand, A-Application, E-Evaluate, C-Create, CL-Cognitive Level, and PO-Program Outcome

Mapping Course Outcomes with Program Outcomes

Course Outcomes	Programme Outcomes									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	*	*	*	*	--	--	--	--	--	*
CO2	*	*	*	*	*	--	--	*	--	*
CO3	*	*	*	*	*	--	--	*	--	*
CO4	*	*	*	*	*	--	--	*	*	*

Course-PO Attainment Matrix

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
Verilog Lab	**3**	**3**	**3**	**3**	**3**	**--**	**--**	**3**	**1**	**3**

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.
If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not addressed.

Course Contents

UNIT – 1: Tutorial and Practice — Duration: 24 Hrs.

Sl. No.	Topic/Exercises	Duration (Hr.)
1	Evolution of Computer-Aided digital design, Introduction to HDL, Importance of HDL, levels of abstraction, types of code-Structural and procedural.	3
2	Introduction to Verilog HDL, Definition, Program Structure of Verilog, **Lexical Tokens/Conventions**-explain with syntax-White Space, Comments, Numbers, Identifiers, Operators, Verilog Keywords. **Data types**-explain with syntax-Value Set, Wire, Reg, Input, Output, Inout Integer, Supply0, Supply1, Time, Parameter. Simple examples.	3
3	**Operators with examples**-Arithmetic, Logical, Relational, Bit-wise, Reduction, Shift, concatenation, Replication, Conditional operators. Operator Precedence.	3

4	**Operands**-explain with syntax-Literals, Wires, Regs, and Parameters, Bit-Selects, Part-Selects, Function Calls. Simple examples.	3
5	**Modules**-Module Declaration, Continuous Assignment, Module Instantiations, Parameterized Modules, Procedures: Always and Initial Blocks. Simple examples.	3
6	**Tasks and Functions**-display, strobe, monitor, reset, stop, finish etc. **Timing Control**-Delay Control(#), Events, wait Statement, join Statements.	3
7	**Behavioral Modeling**-Procedural Assignments, Delay in Assignment, Blocking Assignments, Non-blocking (RTL) Assignments, begin ... end, for Loops, while Loops, forever Loops, if ... else if ... else, disable, case. Simple examples.	3
8	**Functions**-Function Declaration, Return Value, Call, Function Rules, Simple Examples. Brief description about Gate-Level Modeling,Dataflow Modeling, Switch-Level Modeling.	3
	Total	**24**
	Practice Exercises	
	Write and execute verilog code for the following problems 1. Verilog Description for all two input basic gates. 2. Verilog Description for two input Arithmetic operations. 3. Verilog Description for three/four input Logical operations. 4. Compute the output for arithmetic expression. y=(a+b*c)/(a+c) 5. Compute the output for Logical expression. y= (A and B) or (B and C). 6. Verilog Description for 1-bit Full Adder 7. Verilog Description for 2:1 multiplexer using dataflow/behavioral method. 8. Verilog Description for 1:2 De-multiplexer using dataflow/behavioral method. 9. Verilog Description for 2-bit parallel adder. 10. Verilog Description for 2-bit ALU with any 2 arithmetic and logical operations. 11. Verilog Code for D-flipflop 12. Verilog Code for T-flipflop 13. Verilog Description for mod-6 counter.	

UNIT – 2: Graded Exercises Duration: 48 Hr.

Write the verilog code for the following problems and simulate using any HDL simulator/synthesis software (Xilinx/Modelsim/Simulink etc) and download to FPGA/CPLD trainerkits.

Sl. No.	Topic/Exercises	Duration (Hr.)
1	a) Verilog description for full-adder using structural modeling. b) Verilog description for full-adder using behavioral modeling.	3
2	Verilog description for 4-bit ripple carry full-adder using 1-bit full-adder.	3
3	a) Verilog description for BCD to seven segment decoder for common anode display using if else. b) Verilog description for BCD to seven segment decoder using case statement.	3

4	a) Verilog description for 4 -bit parallel adder. b) Verilog description for 4-bit comparator.	3
5	a) Verilog description for 4-bit ALU with three logical & three arithmetic operations. b) Verilog description for any three relational and three bit-wise operations.	3
6	a) Verilog description for 4-to-1 multiplexer using logic equations. b) Verilog description for 4-to-1 multiplexer using conditional operators. c) Verilog description for 4-to-1 multiplexer using behavioral modeling. d) Verilog description for 4-to-1 multiplexer using 2:1 muxes.	6
7	a) Verilog description for clocked T-flip flop. b) Verilog description for edge-triggered D-flip flop.	3
8	a) Verilog description for edge-triggered JK-flip flop. b) Verilog description for 4-bit counter using JK-flip flop.	6
9	a) Verilog description for BCD up/down counter using behavior modeling. b) Verilog description for 4-bit ripple carry counter using T and D-flip flop.	3
10	Verilog description for universal shift register.	3
11	Two open-ended experiments of similar nature as above are to be assigned by the teacher. Student is expected to solve and execute/simulate independently using verilog code.	6
	Two Internal Assessment Tests(CIE)	6
	Total Hours	**48**

Unit – 3: Student Activities [CIE- 05 Marks] 06 Hours & off-classes

Sl. No.	Activity	Duration (Hrs)
1	Develop the algorithm/flowchart and verilog description for the experiments as assigned by the teacher (Student is expected to solve and execute/simulate independently using verilog code). **E.g.**1.Design an 8-function ALU that takes 4-bit inputs A and B and a 3-bit input signal select, and gives a 5-bit output out. 2. Design 8:1 mux using two 4:1 mux. 3.Design the 4-to-1 multiplexer using if and else statements 4.Verilog code for 4 bit binary to gray converter. **Note**: 1.Teacher can assign one experiment per batch (<=4 students) for the student activity. 2. Prepare a Hand-written report of the above activity limited to 4 to 6 pages.	**06 Hrs & Off-class**

References

1. Fundamentals of Digital logic with Verilog design-2e, Brown Vranesic, McGrawHill education, ISBN-13:978-0-07-066724-2.
1. Verilog HDL-A guide to Digital Design and Synthesis-Samir Palnitkar-ISBN: 0134516753; Pub: Prentice Hall PTR.

2. Introduction to Verilog-.Peter M. Nyasulu.
3. Handbook on Verilog HDL-Dr. Daniel C. Hyde,Bucknell University
4. Verilog Tutorial – Deepak Kumar Tala
5. The Verilog Hardware Description Language-Donald Thomas and Philip Moorby (2008)
6. http://www.iitk.ac.in/eclub/summercamp/Courses/CompArch/Verilog_lab_Solutions.pdf
7. http://users.ece.utexas.edu/~ljohn/teaching/ee460m_lab_manual.pdf
8. http://treymorris.com/classes/elen/248/lab/lab%20manuals/lab_manual_5.pdf
9. http://d1.amobbs.com/bbs_upload782111/files_33/ourdev_585395BQ8J9A.pdf
10. www.cc.gatech.edu/~hadi/.../01.../verilog/An%20Introduction%20to%20Verilog.pdf
11. www.ece.niu.edu.tw/~chu/download/fpga/verilog.pdf
12. http://www.asic-world.com/
13. https://www.youtube.com/watch?v=QSEl_O0Gtoo&list=PLoM0uG7tqR3qVss3zhBRniXU7mhHy2bwj

Course Delivery

The course will be normally delivered through two-hour tutorials and four-hour hands-on practice per week; hands-on practice shall include verilog simulation programs. Normally, one-hour tutorial followed by two-hour hands-on practice is recommended in each class. Tutorial shall be imparted before the conduction of the experiment. However, activities are carried-out off-class and demonstration/presentation can be in lab sessions.

Course Assessment and Evaluation Scheme

Master Scheme

Assessment Method	What		To Whom	Assessment mode /Frequency /timing	Max. Marks	Evidence Collected	Course Outcomes
Direct assessment	CIE	IA	Students	Two tests+	**10**	Blue Books	1 to 5
				Record@	**10**	Record Book	1 to 5
				Activity*	**05**	Report/Sheets	1 to 5
	SEE	End exam		End of the course	**50**	Answer Scripts at BTE	1 to 5
				Total	**75**		
Indirect assessment	Student feedback on course		Students	Middle of the Course	Nil	Feedback Forms	1 to 3 & Delivery of course
	End of course survey			End of the Course	Nil	Questionnaires	1 to 5, Effectiveness of delivery instructions & assessment methods

Legends: CIE-Continuous Internal Evaluation, SEE- Semester End-exam Evaluation

[+] Every I.A. test shall be conducted as per SEE scheme of valuation. However, scored marks will be scaled down to 10. Average of two tests, by rounding off any fractional part thereof to next higher integer, shall be considered for IA.

*****Students should do activity as per the list of suggested activities/ similar activities with prior approval of the teacher. Activity process must be initiated well in advance so that it can be completed well before the end of the term. Rubrics to be devised appropriately by the concerned faculty to assess Student activities.

[@]Record Writing: Average of marks allotted for all experiments shall be considered; fractional part of average shall be rounded-off to next higher integer.

Composition of CLs

Sl. No.	Cognitive Levels (CL)	Weightage (%)
1	Remembering	20
2	Understanding	30
3	Applying	40
4	Evaluation	06
5	Create	04
	Total	**100**

Continuous Internal Evaluation (CIE) pattern

(i) Student Activity (5 marks):
The student activities in Unit-3 or similar activities can be assigned by the teacher

Execution Notes:
1. Each batch of 2 students is assigned at least one activity listed in Unit-3 based on interest of the students. Student can also choose any other similar /relevant activity with prior approval from the concerned teacher.
2. Teacher is expected to observe and record the progress of students activities
3. Assessment is made based on quality of work as prescribed by the following **rubrics** table

(ii) Model of rubrics for assessing student activity (for every student)

Dimension	Scale					Marks (Example)
	1 Unsatisfactory	2 Developing	3 Satisfactory	4 Good	5 Exemplary	
1. Information search and Collection.	Does not collect information relate to topic	Collects very limited information, some relate to topic	Collects basic information, most refer to the topic	Collects more information, most refer to the topic	Collects a great deals of information, all refer to the topic	3
2. Full-fills team roles and duties	Does not perform any duties assigned to the team role	Performs very little duties	Performs nearly all duties	Performs almost all duties	Performs all duties of assigned team roles	2

3. Shares work equality	Always relies on others to do the work	Rarely does the assigned work, often needs reminding	Usually does the assigned work, rarely needs reminding	Always does the assigned work, rarely needs reminding.	Always does the assigned work, without needing reminding	5
4. Listening Skills	Is always talking, never allows anyone to else to speak	Usually does most of the talking, rarely allows others to speak	Listens, but sometimes talk too much,	Listens and talks a little more than needed.	Listens and talks a fare amount	3
					Total marks	ceil(13/4)= 4

(iii) CIE/IA Tests (10 Marks)

Two tests shall be conducted in accordance with SEE pattern and the marks shall be scaled down to 10. Average of two tests, rounding-off any fractional part thereof to next higher integer, shall be considered for CIE/IA.

(iv) Record Evaluation (10 Marks)

Every experiment shall be given marks, in the scale of 10, after its conduction based on student's performance and quality of write-up. Average of them, by rounding-off any fractional part thereof to next higher integer, shall be considered for CIE/IA.

Semester End-exam Evaluation (SEE) Scheme

Sl. No.	Scheme	Max. Marks
1	Short questions onUnit-1 (only write-up)	05
2	Writing program and execution steps/procedure for two questions from the graded exercises.	20
3	Execution/Simulation of either one of the programs given in Sl. No. 2 above	15
4	Open-ended problem: Writing one program and its execution/implementation.	05
5	Viva-voce	05
	Total	**50**

Note:

1. Candidate is expected to submit record for the examination.
2. Student shall be allowed to execute the program even if she/he is unable to write the procedure/steps.
3. Open-ended problem is of the nature and magnitude similar to graded exercises in Unit-2, and it can be assigned by the examiner. Further, open-end programs executed in Unit-3 shall be excluded. Idea behind open-end program is to assess the ability of a student to write any program or creativity.

Model Questions for Practice and Semester End Examination

Course Title :**Verilog Lab**	Course Code : **15EC65P**

N**ote:** The questions in the question bank are indicative but not exhaustive.

1. Write a verilog code for half-adder and full-adder using behavioral modelling.
2. Write a verilog code for half-subtractor and full-subtractor using behavioural modeling.
3. Write a verilog code for 4-bit full-adder, Using Dataflow Operators.
4. Write a verilog code for 4 bit parallel adder.
5. Write a verilog code for BCD to seven segment decoder.
6. Write a verilog code for 4 bit parallel adder.
7. Write a verilog codefor 4 bit comparator.
8. Write a verilog codefor 4-to-1 multiplexer, using logic equations.
9. Write a verilog codefor 4-to-1 multiplexer, using conditional operators.
10. Write a verilog codefor behavioral 4-to-1 multiplexer.
11. Write a verilog codefor1:4 de-multiplexer, using logic equations.
12. Write a verilog codefor1:4 de-multiplexer using behavioralmodeling.
13. Write a verilog code for clocked T-flipflop.
14. Write a verilog code for edge-triggered D-flipflop.
15. Write a verilog code for edge-triggered JK-flipflop
16. Write a verilog code forripple counter
17. Write a verilog code forbehavioral 4-bit counter.
18. Write a verilog code foruniversal shift register/left-right shifter using function.
19. Write a Switch-level verilogdescription of 2-to-1 multiplexer.
20. Write a Switch-level verilogdescription of CMOS inverter.
21. Write a Switch-level verilog for NOR-gate
22. Write a verilog code for 4-bit ALU with 3 logical & 3 arithmetic operations
23. Write a verilog code for any 2 relational and 2-bit-wise operations

End

Government of Karnataka
Department of Technical Education
Board of Technical Examinations, Bengaluru

Course Title : **Project Work-II**		Course Code	: **15EC66P**
Semester	: **6**	Course Group	: **Core**
Teaching Scheme in Hr. (L:T:P)	: **0:2:4**	Credits	: **3**
Type of course	: **Tutorial + Practical**	Total Contact Hours	: **78**
CIE	: **25 Marks**	SEE	: **50 Marks**

Prerequisites

Knowledge of electronics and communication engineering, and programming languages.

Course Objectives

Application of the knowledge/concepts acquired in the lower semesters to create/design/implement project relevant to the field of Electronics and Communication Engineering.

Course Outcomes

At the end of the course, the students will be able to

1. Create/Design the project.
2. Implement/Simulate/Test and deploy the project application.
3. Present and defend the project relevance/creation/design/implementation/simulation
4. Prepare project report in a standard format

Course Outcome		CL	Teaching Hrs
CO1	Create/Design the project	***R/U/A/C***	42
CO2	Implement/Simulate/Test and deploy the project application.	***R/U/A/C***	15
CO3	Present and defend the project relevance/creation/design/implementation/simulation	***R/U/A/E/C***	06
CO4	Prepare project report in a standard format	***U/A/E/C***	15
	Total sessions include two tests		**78**

Legend: R-Remember, U-Understand, A-Application, E-Evaluate, C-Create, CL-Cognitive Level, and PO-Program Outcome

Mapping Course Outcomes with Program Outcomes

Course Outcomes	Programme Outcomes									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	*	*	*	*	--	--	*	--	*	*
CO2	*	*	*	*	--	--	--	*	--	*
CO3	*	*	*	*	*	--	*	*	--	*
CO4	*	*	*	*	*	*	--	*	--	*

Course-PO Attainment Matrix

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
Project Work-II	**3**	**3**	**3**	**3**	**3**	**--**	**--**	**3**	**1**	**3**

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.
If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not addressed.

Course Assessment and Evaluation Scheme

Master Scheme

Assessment Method	What		To Whom	Assessment mode /Frequency /timing	Max. Marks	Evidence Collected	Course Outcomes
Direct assessment	CIE	IA	Students	Demonstration	**10**	Project Model/SW	1 to 4
				Presentation	**10**		1 to 4
				Report	**5**	Project Model	1 to 4
	SEE	End exam		End of the course	**50**	Answer Scripts at BTE	1 to 4
				Total	**75**		
Indirect assessment	Student feedback on course		Students	Middle of the Course	Nil	Feedback Forms	1 to 3 & Delivery of course

	End of course survey		End of the Course	Nil	Questionnaires	1 to 4, Effectiveness of delivery instructions & assessment methods

Legends: CIE-Continuous Internal Evaluation, SEE- Semester End-exam Evaluation

+ Every I.A. component shall be conducted as per SEE scheme of valuation.

- Project evaluation is based on the following Rubrics table

Composition of CLs

Sl. No.	Cognitive Levels (CL)	Weightage (%)
1	Remembering	10
2	Understanding	10
3	Applying	30
4	Evaluation	20
5	Create	30
	Total	**100**

Continuous Internal Evaluation (CIE) pattern

(i) Model of rubrics for assessing project activity (for every student)

Dimension	Scale					Marks (Example)
	1 Unsatisfactory	2 Developing	3 Satisfactory	4 Good	5 Exemplary	
1. Information search and Collection.	Does not collect information relate to topic	Collects very limited information, some relate to topic	Collects basic information, most refer to the topic	Collects more information, most refer to the topic	Collects a great deals of information, all refer to the topic	3
2. Full-fills team roles and duties	Does not perform any duties assigned to the team role	Performs very little duties	Performs nearly all duties	Performs almost all duties	Performs all duties of assigned team roles	2
3. Shares work equality	Always relies on others to do the work	Rarely does the assigned work, often needs reminding	Usually does the assigned work, rarely needs reminding	Always does the assigned work, rarely needs reminding.	Always does the assigned work, without needing reminding	5

4. Listening Skills	Is always talking, never allows anyone to else to speak	Usually does most of the talking, rarely allows others to speak	Listens, but sometimes talk too much,	Listens and talks a little more than needed.	Listens and talks a fare amount	3
					Total marks	ceil(13/4)= 4

(ii) CIE/IA (10+10 Marks)

Demonstration and presentation of the project

(iii) Report Evaluation (5 Marks)

Structure of Project report:

1. **Front cover page:** Containing title of the project, year, prescribed authority, names of students, guide name, department, institution name and address.
2. **Certificate page:** Certificate stating the completion of the Bonafide project, certified by guide, HOD and Principal
3. **Abstract**
4. **List of contents/tables/figures**
5. **Body of the report:** Body of the project should normally contain the following appropriate/relevant parts/chapters
   1) Introduction
   2) Literature survey
   3) Block-diagram level conceptualization/system block diagram
   4) Hardware design and implementation
   5) Software design: Flow chart-level dealing
   6) Assembly/Fabrication/User manual/Operational instructions
   7) Conclusion and Future Developments
   8) Reference/Bibliography
6. **Back cover page**
7. **Physical attributes:** Size not to exceed 40 pages (20 sheets) unless it is essentially required. Avoid datasheets and programs unless essentially required. Back to back printing. Spiral binding.
8. **Fonts and Page layout:** A4 size with standard/default MS word page layout. Times New Roman font, Font size: 10 for captions, 12 for running text and sub-titles, 14 for paragraph titles and 16 for chapter titles.

Semester End-exam Evaluation (SEE) Scheme

Sl. No.	Scheme	Max. Marks
1.	Writing block diagram/functional diagram	20
2.	Testing/Demonstration	20
3.	Viva-voce	10
	Total	**50**

Note:

1. Candidate is expected to submit the Project report record for the examination.
2. Project report shall not exceed 40 pages/20 sheets (two-side printing) with spiral binding

End

Government of Karnataka
Department of Technical Education
Board of Technical Examinations, Bengaluru

Course Title : **INPLANT TRAINING**		Course Code	: **15EC67P**
Semester	: **6**	Course Group	: **Core**
Teaching Scheme in Hr. (L:T:P)	: **0:0:4**	Credits	: **2**
Type of course	: **Practical**	Total Contact Hours	: **64**
CIE	: **25 Marks**	SEE	: **Nil**

Prerequisites

Knowledge of electronics and communication engineering, programming languages and management, and enthusiasm to undergo industrial training.

Course Objectives

Exposing the students to the real-world industrial environment to acquire knowledge of various professional skills, working of industry, and interaction with the people, in order to instill confidence and encourage to take-up professions/entrepreneurship to serve the society in general.

Course Outcomes

Course Outcome		CL	Linked POs	Training Hrs
CO1	Identify the industry and their locations, products/expertise/domain, and interact with the authorities there at.	U/A/E/C	2 to 10	**60**
CO2	Acquaint various structural partitions such as labs, workshops, assembly units, stores, and administrative unit and machinery units; understand their functions, applications and maintenance; understand the business model of the industry; and understand the innovations/achievements of the industry.	U/A/E	2 to 10	
CO3	Communicate effectively through technical presentation, report and interactions, and identify career goals and paths based on individual attributes such as affinity, aptitude, strengths and challenges, and inputs from the in-plant training.	U/A/E	2 to 10	
CO4	Enhance communication skills and life-long learning, and acquire technical skills, employability skills, start-up skills, and risks in industry, management skills and such other skills which are conducive to professional engagement.	U/A/E	2 to 10	
			Internal Assessment	04
			Total sessions	64

Legend: R-Remember, U-Understand, A-Application, E-Evaluate, C-Create, CL-Cognitive Level, and PO-Program Outcome

Course Delivery

In-plant training can be imparted in any of the following methods

1. It can be completed at a stretch on daily frequency, amounting to 60 hours, during the fifth semester vacation.
2. It can be completed throughout the sixth semester with one-day per week frequency amounting to 60 hours
3. Any other method as conducive to the training and convenient to the industry and students, without affecting the academics of the remaining courses, with the permission of Principal/HOD and guide.

Note:

1. In-plant training is for all students individually and every student is assigned a guide for supervision and assessment.
2. In-plant training can be in any electronics and communication/IT-based small-scale/medium-scale/large-scale, preferably locally available, industry.
3. Every student has to submit a brief report of the training undergone at the industry. Report should be typed and printed on a A4 size paper and submit after simple/spiral binding.
4. Completion certificate from the industry is optional.

Mapping Course Outcomes with Program Outcomes

Course Outcomes	Programme Outcomes									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	-	-	*	*	*	*	*	*	*	*
CO2	-	-	*	*	*	*	*	*	*	*
CO3	-	-	*	*	*	*	*	*	*	*
CO4	-	-	*	*	*	*	*	*	*	*

Course-PO Attainment Matrix

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
In-plant training	**-**	**-**	**1**	**3**	**3**	**2**	**3**	**1**	**2**	**2**

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.
If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

Course Assessment and Evaluation Scheme

Master Scheme

Assessment Method	What		To Whom	Assessment mode /Frequency /timing	Max. Marks	Evidence Collected	Course Outcomes
Direct assessment	CIE	IA	Students	In-plant Training*	**10**	Attendance and performance appraisal at the palnt	1 to 4
				Presentation/ Viva*	**10**	Presentation material softcopy	1 to 4
				Report*	**5**	Report copy	1 to 4
	SEE	End exam		No end exam			
				Total	**50**		
Indirect assessment	Student feedback on course		Students	Middle of the Course	Nil	Feedback Forms	1 to 3 & Delivery of course
	End of course survey			End of the Course	Nil	Questionnaires	1 to 4, Effectiveness of delivery instructions & assessment methods

Legends: CIE-Continuous Internal Evaluation, SEE- Semester End-exam Evaluation

*Report not exceed 10 pages and qualitative. Assessment for CIE is based on rubrics table

Composition of CLs

Sl. No.	Cognitive Levels (CL)	Weightage (%)
1	Remembering	5

2	Understanding	25
3	Applying	25
4	Evaluation	30
5	Create	15
	Total	**100**

Continuous Internal Evaluation (CIE) pattern

Model of rubrics for assessing CIE (for every student)

Dimension		**Scale**					**Marks (Example)**
		1 Unsatisfactory	**2 Developing**	**3 Satisfactory**	**4 Good**	**5 Exemplary**	
1. Information search and Collection.		Does not collect information relate to topic	Collects very limited information, some relate to topic	Collects basic information, most refer to the topic	Collects more information, most refer to the topic	Collects a great deals of information, all refer to the topic	2
2. Attendance		<65%	65-75%	75-85	85-95	95-100	3
3. Skills acquired/Performance appraisal at plant		E	D	C	B	A	5
4.	Presentation	Very Poor	Poor	Satisfactory	Good	Excellent	5
	internal Viva						5
5. Repot presentation		Very Poor	Poor	Satisfactory	Good	Excellent	5
						Total marks	25

End