

EST 120	BASICS OF CIVIL & MECHANICAL ENGINEERING	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		ESC	4	0	0	4	2019

**Preamble:**

Objective of this course is to provide an insight and inculcate the essentials of Civil Engineering discipline to the students of all branches of Engineering and to provide the students an illustration of the significance of the Civil Engineering Profession in satisfying the societal needs.

To introduce the students to the basic principles of mechanical engineering

**Prerequisite:** NIL

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

CO 1	Recall the role of civil engineer in society and to relate the various disciplines of Civil Engineering.
CO 2	Explain different types of buildings, building components, building materials and building construction
CO 3	Describe the importance, objectives and principles of surveying.
CO 4	Summarise the basic infrastructure services MEP, HVAC, elevators, escalators and ramps
CO 5	Discuss the Materials, energy systems, water management and environment for green buildings.
CO 6	Analyse thermodynamic cycles and calculate its efficiency
CO 7	Illustrate the working and features of IC Engines
CO 8	Explain the basic principles of Refrigeration and Air Conditioning
CO 9	Describe the working of hydraulic machines
CO 10	Explain the working of power transmission elements
CO 11	Describe the basic manufacturing, metal joining and machining processes

**Mapping of course outcomes with program outcomes**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	-	-	-	-	3	2	2	-	-	-	-
CO2	3	2	-	1	3	-	-	3	-	-	-	-
CO3	3	2	-	-	3	-	-	-	2	-	-	-

CO4	3	2	-	-	3	-	-	-	2	-	-	-
CO5	3	2	-	-	3	2	3	-	2	-	-	-
CO6	3	2										
CO7	3	1										
CO8	3	1										
CO9	3	2										
CO10	3	1										
CO11	3											

### Assessment Pattern

Bloom's Category	Basic Civil Engineering			Basic Mechanical Engineering		
	Continuous Assessment		End Semester Examination (marks)	Continuous Assessment		End Semester Examination (marks)
	Test 1 marks	Test 2 marks		Test 1 marks	Test 2 marks	
Remember	5	5	10	7.5	7.5	15
Understand	20	20	40	12.5	12.5	25
Apply				5	5	10
Analyse						
Evaluate						
Create						

### Mark distribution

Total Marks	CIE (Marks)	ESE (Marks)	ESE Duration
150	50	100	3 hours

### Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

### End Semester Examination Pattern:

There will be two parts; Part I – Basic Civil Engineering and Part II – Basic Mechanical Engineering. Part I and PART II carries 50 marks each. For the end semester examination, part I contain 2 parts -

Part A and Part B. Part A contain 5 questions carrying 4 marks each (not exceeding 2 questions from each module). Part B contains 2 questions from each module out of which one to be answered. Each question carries 10 mark and can have maximum 2 sub-divisions. The pattern for end semester examination for part II is same as that of part I. **However, student should answer both part I and part 2 in separate answer booklets.**

#### **Course Level Assessment Questions:**

**Course Outcome CO1:** *To recall the role of civil engineer in society and to relate the various disciplines of Civil Engineering.*

1. Explain relevance of Civil engineering in the overall infrastructural development of the country.

Course outcome 2 (CO2) (One question from each module and not more than two)

*Explain different types of buildings, building components, building materials and building construction*

1. Discuss the difference between plinth area and carpet area.

Course outcome 3 (CO3) (One question from each module and not more than two)

*Describe the importance, objectives and principles of surveying.*

1. Explain the importance of surveying in Civil Engineering

Course outcome 4 (CO4) (One question from each module and not more than two)

*Summarise the basic infrastructure services MEP, HVAC, elevators, escalators and ramps*

1. Explain the civil engineering aspects of elevators, escalators and ramps in buildings

Course outcome 5 (CO5) (One question from each module and not more than two)

*Discuss the Materials, energy systems, water management and environment for green buildings.*

1. Discuss the relevance of Green building in society

**Section II** *Answer any 1 full question from each module. Each full question carries 10 marks*

**Course Outcome 1 (CO1)** (Two full question from each module and each question can have maximum 2 sub-divisions)

*To recall the role of civil engineer in society and to relate the various disciplines of Civil Engineering*

#### **CO Questions**

1. **a** List out the types of building as per occupancy. Explain any two, each in about five sentences.

**b.** Discuss the components of a building with a neat figure.

2. **a.** What are the major disciplines of civil engineering and explain their role in the infrastructural framework.

b. Explain the role of NBC, KBR & CRZ norms in building rules and regulations prevailing in our country.

**Course Outcome 2 (CO2) & Course Outcome 3 (CO3) (Two full question from each module and each question can have maximum 2 sub-divisions)**

*Explain different types of buildings, building components, building materials and building construction & Describe the importance, objectives and principles of surveying.*

**CO Questions**

1. a. What are the different kinds of cement available and what is their use.  
b. List the properties of good building bricks. Explain any five.
2. a. List and explain any five modern construction materials used for construction.  
b. Explain the objectives and principles of surveying

**Course outcome 4 (CO4) & Course outcome 5 (CO5) (Two full question from each module and each question can have maximum 2 sub-divisions)**

*Summarise the basic infrastructure services MEP, HVAC, elevators, escalators and ramps & Discuss the Materials, energy systems, water management and environment for green buildings.*

**CO Questions**

1. a. Draw the elevation and plan of one brick thick wall with English bond  
b. Explain the energy systems and water management in Green buildings
2. a. Draw neat sketch of the following foundations: (i) Isolated stepped footing;  
(ii) Cantilever footing; and (iii) Continuous footing.  
  
b. Discuss the civil engineering aspect of MEP and HVAC in a commercial building

**Course Outcome 6 (CO6):**

1. In an air standard Otto cycle the compression ratio is 7 and compression begins at 35°C, 0.1 MPa. The maximum temperature of the cycle is 1100°C. Find
  - i) Heat supplied per kg of air,
  - ii) Work done per kg of air,
  - iii) Cycle efficiencyTake  $C_p = 1.005 \text{ kJ/kgK}$  and  $C_v = 0.718 \text{ kJ/kgK}$
2. A Carnot cycle works with adiabatic compression ratio of 5 and isothermal expansion ratio of 2. The volume of air at the beginning of isothermal expansion is  $0.3 \text{ m}^3$ . If the maximum temperature and pressure is limited to 550K and 21 bar, determine the minimum temperature in the cycle and efficiency of the cycle.
3. In an ideal diesel cycle, the temperature at the beginning and end of compression is 65°C and 620°C respectively. The temperature at the beginning and end of the expansion is 1850°C and 850°C. Determine the ideal efficiency of the cycle.

4. Explain the concepts of CRDI and MPFI in IC Engines.

**Course Outcome 7 (CO7)**

1. With the help of a neat sketch explain the working of a 4 stroke SI engine
2. Compare the working of 2 stroke and 4 stroke IC engines
3. Explain the classification of IC Engines.

**Course Outcome 8(CO8):**

1. Explain the working of vapour compression refrigeration system.
2. With the help of suitable sketch explain the working of a split air conditioner.
3. Define: COP, specific humidity, relative humidity and dew point temperature.

**Course Outcome 9 (CO9):**

1. Explain the working of a single stage centrifugal pump with sketches.
2. With the help of a neat sketch, explain the working of a reciprocating pump.
3. A turbine is to operate under a head of 25 m at 200 rpm. The discharge is  $9 \text{ m}^3/\text{s}$ . If the overall efficiency of the turbine is 90%. Determine the power developed by the turbine.

**Course Outcome 10 (CO10):**

1. Explain the working of belt drive and gear drive with the help of neat sketches
2. Explain a single plate clutch.
3. Sketch different types of gear trains and explain.

**Course Outcome 11 (CO11):**

1. Describe the operations which can be performed using drilling machine.
2. Explain the functions of runners and risers used in casting.
3. With a neat sketch, explain the working and parts of a lathe.

**Model Question Paper**

**QP CODE: EST120**

page:3

Reg No: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION,  
MONTH & YEAR**

**Course Code: EST 120**

**Course Name: BASICS OF CIVIL AND MECHANICAL ENGINEERING**

Max. Marks: 100

Duration: 3 hours

**Answer both part I and part 2 in separate answer booklets**

## PART I: BASIC CIVIL ENGINEERING

### PART A

(Answer all questions. Each question carries 4 marks)

1. Explain relevance of Civil engineering in the overall infrastructural development of the country.
2. Discuss the difference between plinth area and carpet area.
3. Explain different types of steel with their properties.
4. What are the different kinds of cement available and what is their use?
5. Define bearing capacity of soil.

(5 x 4 = 20)

### Part B

Answer one full question from each module.

#### MODULE I

- 6a. List out the types of building as per occupancy. Explain any two, each in about five sentences. (5)
- b. Discuss the components of a building with a neat figure. (5)

OR

- 7a. What are the major disciplines of civil engineering and explain their role in the infrastructural framework. (5)
- b. Explain the role of NBC, KBR & CRZ norms in building rules and regulations prevailing in our country. (5)

#### MODULE II

- 8a. What are the different kinds of cement available and what is their use. (5)
- b. List the properties of good building bricks. Explain any five. (5)

OR

- 9a. List and explain any five modern construction materials used for construction. (5)
- b. Explain the objectives and principles of surveying (5)

#### MODULE III

- 10a. Draw the elevation and plan of one brick thick wall with English bond (5)
- b. Explain the energy systems and water management in Green buildings (5)

OR

- 11a. Draw neat sketch of the following foundations: (i) Isolated stepped footing; (ii) Cantilever footing; and (iii) Continuous footing. (5)
- b. Discuss the civil engineering aspect of MEP and HVAC in a commercial building (5)

[10 x 3 = 30]

## PART II: BASIC MECHANICAL ENGINEERING

### PART A

Answer all questions. Each question carries 4 marks

1. Sketch the P-v and T-s diagram of a Carnot cycle and List the processes.
2. Illustrate the working of an epicyclic gear train.
3. Explain cooling and dehumidification processes.
4. Differentiate between soldering and brazing.
5. Explain the principle of Additive manufacturing.

4 x 5 = 20 marks

### Part B

Answer one full question from each module.

#### MODULE I

6. In an air standard Otto cycle the compression ratio is 7 and compression begins at 35°C, 0.1MPa. The maximum temperature of the cycle is 1100°C. Find
  - i) Heat supplied per kg of air,
  - ii) Work done per kg of air,
  - iii) Cycle efficiency

Take  $C_p = 1.005 \text{ kJ/kgK}$  and  $C_v = 0.718 \text{ kJ/kgK}$

10 marks

OR

7. a) Explain the working of a 4 stroke SI engine with neat sketches. 7 marks  
b) Explain the fuel system of a petrol engine. 3 marks

#### MODULE II

8. a) Explain the working of a vapour compression system with help of a block diagram. 7 marks  
b) Define: Specific humidity, relative humidity and dew point temperature. 3 marks

OR

9. With the help of a neat sketch, explain the working of a centrifugal pump. 10 marks

#### MODULE III

10. Explain the two high, three high, four high and cluster rolling mills with neat sketches. 10 marks

OR

11. a) Describe the arc welding process with a neat sketch. 6 marks  
b) Differentiate between up-milling and down-milling operations. 4 marks

## SYLLABUS

### Module 1

**General Introduction to Civil Engineering:** Relevance of Civil Engineering in the overall infrastructural development of the country. Responsibility of an engineer in ensuring the safety of built environment. Brief introduction to major disciplines of Civil Engineering like Transportation Engineering, Structural Engineering, Geo-technical Engineering, Water Resources Engineering and Environmental Engineering.

**Introduction to buildings:** Types of buildings, selection of site for buildings, components of a residential building and their functions.

**Building rules and regulations:** Relevance of NBC, KBR & CRZ norms (brief discussion only).

**Building area:** Plinth area, built up area, floor area, carpet area and floor area ratio for a building as per KBR.

### Module 2

**Surveying:** Importance, objectives and principles.

**Construction materials,** Conventional construction materials: types, properties and uses of building materials: bricks, stones, cement, sand and timber

**Cement concrete:** Constituent materials, properties and types.

**Steel:** Steel sections and steel reinforcements, types and uses.

**Modern construction materials:-** Architectural glass, ceramics, Plastics, composite materials, thermal and acoustic insulating materials, decorative panels, waterproofing materials. Modern uses of gypsum, pre-fabricated building components (brief discussion only).

### Module 3

**Building Construction:** Foundations: Bearing capacity of soil (definition only), functions of foundations, types – shallow and deep (brief discussion only). Load bearing and framed structures (concept only).

**Brick masonry:** - Header and stretcher bond, English bond & Flemish bond random rubble masonry.

**Roofs and floors:** - Functions, types; flooring materials (brief discussion only).

**Basic infrastructure services:** MEP, HVAC, elevators, escalators and ramps (Civil Engineering aspects only), fire safety for buildings.

**Green buildings:-** Materials, energy systems, water management and environment for green buildings. (brief discussion only).

### Module 4

**Analysis of thermodynamic cycles:** Carnot, Otto, Diesel cycles, Derivation of efficiency of these cycles, Problems to calculate heat added, heat rejected, net work and efficiency. IC Engines: CI, SI, 2-Stroke, 4-Stroke engines. Listing the parts of different types of IC Engines. Efficiencies of IC Engines(Definitions only), Air, Fuel, cooling and lubricating systems in SI and CI Engines, CRDI, MPFI. Concept of hybrid engines.



### Module 5

**Refrigeration:** Unit of refrigeration, reversed Carnot cycle, COP, vapour compression cycle (only description and no problems); Definitions of dry, wet & dew point temperatures, specific humidity and relative humidity, Cooling and dehumidification, Layout of unit and central air conditioners.

Description about working with sketches of: Reciprocating pump, Centrifugal pump, Pelton turbine, Francis turbine and Kaplan turbine. Overall efficiency, Problems on calculation of input and output power of pumps and turbines (No velocity triangles)

Description about working with sketches of: Belt and Chain drives, Gear and Gear trains, Single plate clutches.

### Module 6

**Manufacturing Process:** Basic description of the manufacturing processes – Sand Casting, Forging, Rolling, Extrusion and their applications.

Metal Joining Processes: List types of welding, Description with sketches of Arc Welding, Soldering and Brazing and their applications

Basic Machining operations: Turning, Drilling, Milling and Grinding.

Description about working with block diagram of: Lathe, Drilling machine, Milling machine, CNC Machine. Principle of CAD/CAM, Rapid and Additive manufacturing.

#### Text Books:

1. Rangwala, S. C., Essentials of Civil Engineering, Charotar Publishing House
2. Mckay, W.B. and Mckay, J. K., Building Construction, Volumes 1 to 4, Pearson India Education Services

#### References Books:

1. Chen W.F and Liew J Y R (Eds), The Civil Engineering Handbook. II Edition CRC Press (Taylor and Francis)
2. Chudley, R and Greeno R, Building construction handbook, Addison Wesley, Longman group, England
3. Chudley, R, Construction Technology, Vol. I to IV, Longman group, England Course Plan
4. Kandya A A, Elements of Civil Engineering, Charotar Publishing house
5. Mamlouk, M. S., and Zaniewski, J. P., Materials for Civil and Construction Engineering, Pearson Publishers
6. Rangwala S.C and Dalal K B Building Construction Charotar Publishing house
7. Clifford, M., Simmons, K. and Shipway, P., An Introduction to Mechanical Engineering Part I - CRC Press
8. Roy and Choudhary, Elements of Mechanical Engineering, Media Promoters & Publishers Pvt. Ltd., Mumbai.
9. Sawhney, G. S., Fundamentals of Mechanical Engineering, PHI
10. G Shanmugam, M S Palanichamy, Basic Civil and Mechanical Engineering, McGraw Hill Education; First edition, 2018
11. Benjamin, J., Basic Mechanical Engineering, Pentex Books, 9<sup>th</sup> Edition, 2018
12. Balachandran, P. Basic Mechanical Engineering, Owl Books

**Course Contents and Lecture Schedule:**

No	Topic	Course outcomes addressed	No. of Lectures
<b>1</b>	<b>Module I</b>		<b>Total: 7</b>
1.1	<i>General Introduction to Civil Engineering:</i> Relevance of Civil Engineering in the overall infrastructural development of the country. Responsibility of an engineer in ensuring the safety of built environment.	CO1	1
1.2	Brief introduction to major disciplines of Civil Engineering like Transportation Engineering, Structural Engineering, Geo-technical Engineering, Water Resources Engineering and Environmental Engineering.	CO1	2
1.3	<i>Introduction to buildings:</i> Types of buildings, selection of site for buildings, components of a residential building and their functions.	CO2	2
1.4	<i>Building rules and regulations:</i> Relevance of NBC, KBR & CRZ norms (brief discussion only)	CO2	1
1.5	<i>Building area:</i> Plinth area, built up area, floor area, carpet area and floor area ratio for a building as per KBR.	CO2	1
<b>2</b>	<b>Module 2</b>		<b>Total: 7</b>
2.1	<i>Surveying:</i> Importance, objectives and principles.	CO3	1
2.2	Bricks: - Classification, properties of good bricks, and tests on bricks	CO2	1
2.3	Stones: - <i>Qualities</i> of good stones, types of stones and their uses. Cement: - Good qualities of cement, types of cement and their uses.	CO2	1
2.4	Sand: - Classification, qualities of good sand and sieve analysis (basics only). Timber: - Characteristics, properties and uses.	CO2	1
2.5	Cement concrete: - Constituent materials, properties and types, Steel: - Steel sections and steel reinforcements, types and uses.	CO2	1

2.6	Modern construction materials: - Architectural glass, ceramics, plastics, composite materials, thermal and acoustic insulating materials, decorative panels, waterproofing materials, modern uses of gypsum, pre-fabricated building components (brief discussion only)	CO2	2
<b>3</b>	<b>Module 3</b>		<b>Total: 7</b>
3.1	Foundations: - Bearing capacity of soil (definition only), functions of foundations, types – shallow and deep (brief discussion only). Brick masonry: - Header and stretcher bond, English bond & Flemish bond– elevation and plan (one & one and a half brick wall only). Random rubble masonry.	CO2	2
3.2	Roofs: Functions, types; roofing materials (brief discussion only) Floors: Functions, types; flooring materials (brief discussion only)	CO2	2
3.3	<i>Basic infrastructure services:</i> MEP, HVAC, Elevators, escalators and ramps (Civil Engineering aspects only) fire safety for buildings	CO4	2
3.4	<i>Green buildings:-</i> Materials, energy systems, water management and environment for green buildings. (brief discussion only)	CO5	1
<b>4</b>	<b>MODULE 4</b>		
4.1	Analysis of thermodynamic cycles: Carnot, Otto, and Diesel cycle- Derivation of efficiency of these cycles, Problems to calculate heat added, heat rejected, net work and efficiency		4
4.2	IC Engines: CI, SI, 2-Stroke, 4-Stroke engines. Listing the parts of different types of IC Engines, efficiencies of IC Engines(Description only)		2
4.3	Air, Fuel, cooling and lubricating systems in SI and CI Engines, CRDI, MPFI. Concept of hybrid engines		2
<b>5</b>	<b>MODULE 5</b>		
5.1	Refrigeration: Unit of refrigeration, reversed Carnot cycle, COP, vapour compression cycle (only description and no problems)		1
5.2	Definitions of dry, wet & dew point temperatures, specific humidity and relative humidity, Cooling and dehumidification, Layout of unit and central air conditioners.		1

5.3	Description about working with sketches : Reciprocating pump, Centrifugal pump, Pelton turbine, Francis turbine and Kaplan turbine. Overall efficiency, Problems on calculation of input and output power of pumps and turbines (No velocity triangles)	4
5.4	Description about working with sketches of: Belt and Chain drives, Gear and Gear trains, Single plate clutches	3
6	<b>MODULE 6</b>	
6.1	Manufacturing Process: Basic description of the manufacturing processes – Sand Casting, Forging, Rolling, Extrusion and their applications.	2
6.2	Metal Joining Processes :List types of welding, Description with sketches of Arc Welding, Soldering and Brazing, and their applications	1
6.3	Basic Machining operations: Turning, Drilling, Milling and Grinding Description about working with block diagrams of: Lathe, Drilling machine, Milling machine, CNC Machine	3
6.4	Principle of CAD/CAM, Rapid and Additive manufacturing	1

EST 130	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		ESC	4	0	0	4	2019

**Preamble:**

This course aims to (1) equip the students with an understanding of the fundamental principles of electrical engineering (2) provide an overview of evolution of electronics, and introduce the working principle and examples of fundamental electronic devices and circuits (3) provide an overview of evolution of communication systems, and introduce the basic concepts in radio communication.

**Prerequisite:** Physics and Mathematics (Pre-university level)

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

CO 1	Apply fundamental concepts and circuit laws to solve simple DC electric circuits
CO 2	Develop and solve models of magnetic circuits
CO 3	Apply the fundamental laws of electrical engineering to solve simple ac circuits in steady state
CO 4	Describe working of a voltage amplifier
CO 5	Outline the principle of an electronic instrumentation system
CO 6	Explain the principle of radio and cellular communication

**Mapping of course outcomes with program outcomes**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	1	-	-	-	-	-	-	-	-	-	2
CO 2	3	1	-	-	-	-	-	-	-	-	-	2
CO 3	3	1	-	-	-	-	-	-	-	-	-	2
CO 4	2	-	-	-	-	-	-	-	-	-	-	-
CO 5	2	-	-	-	-	-	-	-	-	-	-	2
CO 6	2	-	-	-	-	-	-	-	-	-	-	2

**Assessment Pattern**

Bloom's Category	Basic Electrical Engineering			Basic Electronics Engineering		
	Continuous Assessment Tests		End Semester Examination (Marks)	Continuous Assessment Tests		End Semester Examination (Marks)
	Test 1 (Marks)	Test 2 (Marks)		Test 1 (Marks)	Test 2 (Marks)	
Remember	0	0	10	10	10	20
Understand	12.5	12.5	20	15	15	30
Apply	12.5	12.5	20			
Analyse						
Evaluate						
Create						

### Mark distribution

Total Marks	CIE marks	ESE marks	ESE Duration
150	50	100	3 hours

#### Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

**End Semester Examination Pattern:** There will be two parts; Part I – Basic Electrical Engineering and Part II – Basic Electronics Engineering. Part I and PART II carries 50 marks each. For the end semester examination, part I contain 2 parts - Part A and Part B. Part A contain 5 questions carrying 4 marks each (not exceeding 2 questions from each module). Part B contains 2 questions from each module out of which one to be answered. Each question carries 10 mark and can have maximum 2 sub-divisions. The pattern for end semester examination for part II is same as that of part I. **However, student should answer both part I and part 2 in separate answer booklets.**

#### Course Level Assessment Questions

##### Course Outcome 1 (CO1):

1. Solve problems based on current division rule.
2. Solve problems with Mesh/node analysis.
3. Solve problems on Wye-Delta Transformation.

##### Course Outcome 2 (CO2):

1. Problems on series magnetic circuits
2. Problems on parallel magnetic circuits
3. Problems on composite magnetic circuits

##### 4. Course Outcome 3 (CO3):

1. problems on self inductance, mutual inductance and coefficient of coupling
2. problems on rms and average values of periodic waveforms
3. problems on series ac circuits
4. Compare star and Delta connected 3 phase AC systems.

##### Course Outcome 4 (CO4): Describe working of a voltage amplifier

1. What is the need of voltage divider biasing in an RC coupled amplifier?

2. Define operating point in the context of a BJT amplifier.
3. Why is it required to have a voltage amplifier in a public address system?

**Course Outcome 5 (CO5):** Outline the principle of an electronic instrumentation system

1. Draw the block diagram of an electronic instrumentation system.
2. What is a transducer?
3. Explain the working principle of operation of digital multimeter.

**Course Outcome 6 (CO6):** Explain the principle of radio and cellular communication

1. What is the working principle of an antenna when used in a radio transmitter?
2. What is the need of two separate sections RF section and IF section in a super heterodyne receiver?
3. What is meant by a cell in a cellular communication?

**Model Question Paper**

**QP CODE:**

Pages: 3

Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION,  
MONTH & YEAR**

**Course Code: EST 130**

**Course Name: BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING**

Max. Marks: 100

Duration: 3 hours

**Answer both part I and part 2 in separate answer booklets**

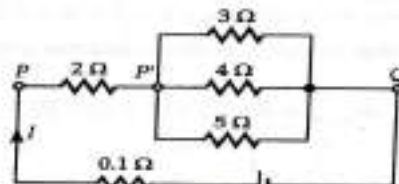
**PART I**

**BASIC ELECTRICAL ENGINEERING**

**PART A**

**Answer all questions; each question carries 4 marks.**

1. Calculate the current through the  $4\Omega$  resistor in the circuit shown, applying current division rule:



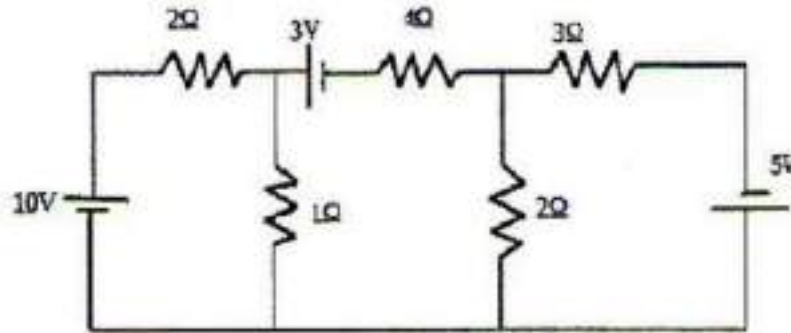
2. Calculate the RMS and average values of a purely sinusoidal current having peak value 15A.
3. An alternating voltage of  $(80+j60)V$  is applied to an RX circuit and the current flowing through the circuit is  $(-4+j10)A$ . Calculate the impedance of the circuit in rectangular and polar forms. Also determine if X is inductive or capacitive.
4. Derive the relation between line and phase values of voltage in a three phase star connected system.
5. Compare electric and magnetic circuits. (5x4=20)

**PART B**

**Answer one question from each module; each question carries 10 marks.**

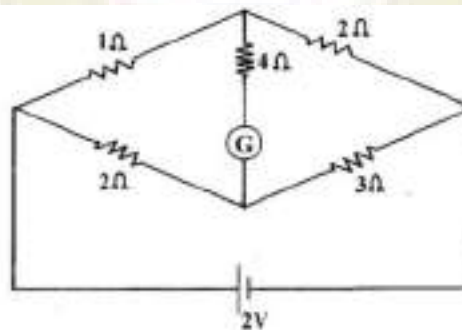
**Module 1**

6. . Calculate the node voltages in the circuit shown, applying node analysis:



7. (a) State and explain Kirchoff's laws. (4 marks)

- (b) Calculate the current through the galvanometer (G) in the circuit shown:



(6 marks)



## Module 2

8. (a) State and explain Faraday's laws of electromagnetic induction with examples. (4 marks)
- (b) Differentiate between statically and dynamically induced emf. A conductor of length 0.5m moves in a uniform magnetic field of flux density 1.1T at a velocity of 30m/s. Calculate the emf induced in the conductor if the direction of motion of the conductor is inclined at  $60^\circ$  to the direction of field. (6 marks)
9. (a) Derive the amplitude factor and form factor of a purely sinusoidal waveform. (5 marks)
- (b) A current wave is made up of two components—a 5A dc component and a 50Hz ac component, which is a sinusoidal wave with a peak value of 5A. Sketch the resultant waveform and determine its RMS and average values. (5 marks)

## Module 3

10. Draw the power triangle and define active, reactive and apparent powers in ac circuits. Two coils A and B are connected in series across a 240V, 50Hz supply. The resistance of A is  $5\Omega$  and the inductance of B is 0.015H. If the input from the supply is 3kW and 2kVAR, find the inductance of A and the resistance of B. Also calculate the voltage across each coil.
11. A balanced three phase load consists of three coils each having resistance of  $4\Omega$  and inductance 0.02H. It is connected to a 415V, 50Hz, 3-phase ac supply. Determine the phase voltage, phase current, power factor and active power when the loads are connected in (i) star (ii) delta.

(3x10=30)

## PART II

### BASIC ELECTRONICS ENGINEERING

## PART A

**Answer all questions; each question carries 4 marks.**

1. Give the specifications of a resistor. The colour bands marked on a resistor are Blue, Grey, Yellow and Gold. What are the minimum and maximum resistance values expected from that resistance?
2. What is meant by avalanche breakdown?
3. Explain the working of a full-wave bridge rectifier.
4. Discuss the role of coupling and bypass capacitors in a single stage RC coupled amplifier.
5. Differentiate AM and FM communication systems.

(5x4=20)

## PART B

*Answer one question from each module; each question carries 10 marks.*

### Module 4

6. a) Explain with diagram the principle of operation of an NPN transistor. (5)  
b) Sketch and explain the typical input-output characteristics of a BJT when connected in common emitter configuration. (5)

**OR**

7. a) Explain the formation of a potential barrier in a P-N junction diode. (5)  
b) What do you understand by Avalanche breakdown? Draw and explain the V-I characteristics of a P-N junction and Zener diode. (5)

### Module 5

8. a) With a neat circuit diagram, explain the working of an RC coupled amplifier. (6)  
b) Draw the frequency response characteristics of an RC coupled amplifier and state the reasons for the reduction of gain at lower and higher frequencies. (4)

**OR**

9. a) With the help of block diagram, explain how an electronic instrumentation system. (6)  
b) Explain the principle of an antenna. (4)

### Module 6

10. a) With the help of a block diagram, explain the working of Super hetrodyne receiver. (6)  
b) Explain the importance of antenna in a communication system. (4)

**OR**

11. a) With neat sketches explain a cellular communication system. (5)  
b) Explain GSM communication with the help of a block diagram. (5)

(3x10=30)

## SYLLABUS

### MODULE 1: Elementary Concepts of Electric Circuits

**Elementary concepts of DC electric circuits:** Basic Terminology including voltage, current, power, resistance, emf; Resistances in series and parallel; Current and Voltage Division Rules; Capacitors & Inductors: V-I relations and energy stored. Ohms Law and Kirchhoff's laws-Problems; Star-delta conversion (resistive networks only-derivation not required)-problems.

**Analysis of DC electric circuits:** Mesh current method - Matrix representation - Solution of network equations. Node voltage methods-matrix representation-solution of network equations by matrix methods. Numerical problems.

### MODULE 2: Elementary Concepts of Magnetic circuits, Electromagnetic Induction and AC fundamentals

**Magnetic Circuits:** Basic Terminology: MMF, field strength, flux density, reluctance - comparison between electric and magnetic circuits- Series and parallel magnetic circuits with composite materials, numerical problems.

**Electromagnetic Induction:** Faraday's laws, problems, Lenz's law- statically induced and dynamically induced emfs - Self-inductance and mutual inductance, coefficient of coupling

**Alternating Current fundamentals:** Generation of alternating voltages-Representation of sinusoidal waveforms: frequency, period, Average, RMS values and form factor of waveforms-Numerical Problems.

### MODULE 3: AC Circuits

**AC Circuits:** Phasor representation of sinusoidal quantities. Trigonometric, Rectangular, Polar and complex forms. Analysis of simple AC circuits: Purely resistive, inductive & capacitive circuits; Inductive and capacitive reactance, concept of impedance. Average Power Power factor. Analysis of RL, RC and RLC series circuits-active, reactive and apparent power. Simple numerical problems.

**Three phase AC systems:** Generation of three phase voltages; advantages of three phase systems, star and delta connections (balanced only), relation between line and phase voltages, line and phase currents- Numerical problems

### MODULE 4

**Introduction to Semiconductor devices:** Evolution of electronics – Vacuum tubes to nano electronics. Resistors, Capacitors and Inductors (constructional features not required): types, specifications. Standard values, color coding. PN Junction diode: Principle of operation, V-I characteristics, principle of avalanche breakdown. Bipolar Junction Transistors: PNP and NPN structures, Principle of operation, relation between current gains in CE, CB and CC, input and output characteristics of common emitter configuration.

## MODULE 5

**Basic electronic circuits and instrumentation:** Rectifiers and power supplies: Block diagram description of a dc power supply, Working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple zener voltage regulator. Amplifiers: Block diagram of Public Address system, Circuit diagram and working of common emitter (RC coupled) amplifier with its frequency response, Concept of voltage divider biasing. Electronic Instrumentation: Block diagram of an electronic instrumentation system.

## MODULE 6

**Introduction to Communication Systems:** Evolution of communication systems – Telegraphy to 5G. Radio communication: principle of AM & FM, frequency bands used for various communication systems, block diagram of super heterodyne receiver, Principle of antenna – radiation from accelerated charge. Mobile communication: basic principles of cellular communications, principle and block diagram of GSM.

### Text Books

1. D P Kothari and I J Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. D C Kulshreshtha, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
3. ChinmoySaha, Arindham Halder and Debarati Ganguly, Basic Electronics - Principles and Applications, Cambridge University Press, 2018.
4. M.S.Sukhija and T.K.Nagsarkar, Basic Electrical and Electronics Engineering, Oxford University Press, 2012.
5. Wayne Tomasi and Neil Storey, A Textbook On Basic Communication and Information Engineering, Pearson, 2010.

### Reference Books

1. Del Toro V, "Electrical Engineering Fundamentals", Pearson Education.
2. T. K. Nagsarkar, M. S. Sukhija, "Basic Electrical Engineering", Oxford Higher Education.
3. Hayt W H, Kemmerly J E, and Durbin S M, "Engineering Circuit Analysis", Tata McGraw-Hill
4. Hughes, "Electrical and Electronic Technology", Pearson Education.
5. V. N. Mittle and Arvind Mittal, "Basic Electrical Engineering," Second Edition, McGraw Hill.
6. Parker and Smith, "Problems in Electrical Engineering", CBS Publishers and Distributors.
7. S. B. Lal Seksena and Kaustuv Dasgupta, "Fundamentals of Electrical Engineering", Cambridge University Press.
8. Anant Agarwal, Jeffrey Lang, Foundations of Analog and Digital Electronic Circuits, Morgan Kaufmann Publishers, 2005.
9. Bernard Grob, Basic Electronics, McGraw Hill.
10. A. Bruce Carlson, Paul B. Crilly, Communication Systems: An Introduction to Signals and Noise in Electrical Communication, Tata McGraw Hill, 5<sup>th</sup> Edition.

## COURSE CONTENTS AND LECTURE SCHEDULE

No	Topic	No. of Lectures
<b>1</b>	<b><i>Elementary Concepts of Electric Circuits</i></b>	
1.1	<p><b>Elementary concepts of DC electric circuits:</b></p> <p>Basic Terminology including voltage, current, power, resistance, emf; Resistances in series and parallel; Current and Voltage Division Rules; Capacitors &amp; Inductors: V-I relations and energy stored.</p> <p>Ohms Law and Kirchhoff's laws-Problems;</p> <p>Star-delta conversion (resistive networks only-derivation not required)-problems.</p>	1 2 1
1.2	<p><b>Analysis of DC electric circuits:</b> Mesh current method - Matrix representation - Solution of network equations.</p> <p>Node voltage methods-matrix representation-solution of network equations by matrix methods.</p> <p>Numerical problems.</p>	1 1 2
<b>2</b>	<b>Elementary Concepts of Magnetic circuits, Electromagnetic Induction and AC fundamentals</b>	
2.1	<p><b>Magnetic Circuits:</b> Basic Terminology: MMF, field strength, flux density, reluctance - comparison between electric and magnetic circuits-</p> <p>Series and parallel magnetic circuits with composite materials, numerical problems.</p>	1 2
2.2	<p><b>Electromagnetic Induction:</b> Faraday's laws, problems, Lenz's law-statically induced and dynamically induced emfs -</p> <p>Self-inductance and mutual inductance, coefficient of coupling</p>	1 2
2.3	<p><b>Alternating Current fundamentals:</b> Generation of alternating voltages-Representation of sinusoidal waveforms: frequency, period, Average, RMS values and form factor of waveforms-Numerical Problems.</p>	2
<b>3</b>	<b>AC Circuits</b>	

3.1	<p><b>AC Circuits:</b> Phasor representation of sinusoidal quantities. Trigonometric, Rectangular, Polar and complex forms.</p> <p>Analysis of simple AC circuits: Purely resistive, inductive &amp; capacitive circuits; Inductive and capacitive reactance, concept of impedance. Average Power, Power factor.</p> <p>Analysis of RL, RC and RLC series circuits-active, reactive and apparent power.</p> <p>Simple numerical problems.</p>	1 2 1 2
3.2	<p><b>Three phase AC systems:</b> Generation of three phase voltages; advantages of three phase systems, star and delta connections (balanced only), relation between line and phase voltages, line and phase currents- Numerical problems.</p>	2
<b>4</b>	<b>Introduction to Semiconductor devices</b>	
4.1	Evolution of electronics – Vacuum tubes to nano electronics (In evolutionary perspective only)	1
4.2	Resistors, Capacitors and Inductors: types, specifications. Standard values, color coding (No constructional features)	2
4.3	<b>PN Junction diode:</b> Principle of operation, V-I characteristics, principle of avalanche breakdown	2
4.4	<b>Bipolar Junction Transistors:</b> PNP and NPN structures, Principle of operation, relation between current gains in CE, CB and CC, input and output characteristics of common emitter configuration	3
<b>5</b>	<b>Basic electronic circuits and instrumentation</b>	
5.1	<b>Rectifiers and power supplies:</b> Block diagram description of a dc power supply, Working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple zener voltage regulator	3
5.2	<b>Amplifiers:</b> Block diagram of Public Address system, Circuit diagram and working of common emitter (RC coupled) amplifier with its frequency response, Concept of voltage divider biasing	4
5.3	<b>Electronic Instrumentation:</b> Block diagram of an electronic instrumentation system	2
<b>6</b>	<b>Introduction to Communication Systems</b>	
6.1	Evolution of communication systems – Telegraphy to 5G	1

6.2	<b>Radio communication:</b> principle of AM & FM, frequency bands used for various communication systems, block diagram of super heterodyne receiver, Principle of antenna – radiation from accelerated charge	4
6.3	<b>Mobile communication:</b> basic principles of cellular communications, principle and block diagram of GSM.	2

### Suggested Simulation Assignments for Basic Electronics Engineering

1. Plot V-I characteristics of Si and Ge diodes on a simulator
2. Plot Input and Output characteristics of BJT on a simulator
3. Implementation of half wave and full wave rectifiers
4. Simulation of RC coupled amplifier with the design supplied
5. Generation of AM signal

Note: The simulations can be done on open tools such as QUCS, KiCad, GNURadio or similar software to augment the understanding.

EST 102	PROGRAMING IN C	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		ESC	2	1	2	4	2019

**Preamble:** The syllabus is prepared with the view of preparing the Engineering Graduates capable of writing readable C programs to solve computational problems that they may have to solve in their professional life. The course content is decided to cover the essential programming fundamentals which can be taught within the given slots in the curriculum. This course has got 2 Hours per week for practicing programming in C. A list showing 24 mandatory programming problems are given at the end. The instructor is supposed to give homework/assignments to write the listed programs in the rough record as and when the required theory part is covered in the class. The students are expected to come prepared with the required program written in the rough record for the lab classes.

**Prerequisite: NIL**

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

<b>CO 1</b>	Analyze a computational problem and develop an algorithm/flowchart to find its solution
<b>CO 2</b>	Develop readable* C programs with branching and looping statements, which uses Arithmetic, Logical, Relational or Bitwise operators.
<b>CO 3</b>	Write readable C programs with arrays, structure or union for storing the data to be processed
<b>CO 4</b>	Divide a given computational problem into a number of modules and develop a readable multi-function C program by using recursion if required, to find the solution to the computational problem
<b>CO 5</b>	Write readable C programs which use pointers for array processing and parameter passing
<b>CO 6</b>	Develop readable C programs with files for reading input and storing output
readable* - readability of a program means the following: <ol style="list-style-type: none"> <li>1. Logic used is easy to follow</li> <li>2. Standards to be followed for indentation and formatting</li> <li>3. Meaningful names are given to variables</li> <li>4. Concise comments are provided wherever needed</li> </ol>	



### Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	☑	☑	☑	☑		☑				☑	☑	☑
CO2	☑	☑	☑	☑	☑					☑		☑
CO3	☑	☑	☑	☑	☑					☑		☑
CO4	☑	☑	☑	☑	☑					☑	☑	☑
CO5	☑	☑			☑					☑		☑
CO6	☑	☑			☑					☑		☑

### Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination Marks
	Test 1 (Marks)	Test 2 (Marks)	
Remember	15	10	25
Understand	10	15	25
Apply	20	20	40
Analyse	5	5	10
Evaluate			
Create			

### Mark distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

### Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test 1 (for theory, for 2 hrs)	: 20 marks
Continuous Assessment Test 2 (for lab, internal examination, for 2 hrs)	: 20 marks

**Internal Examination Pattern:** There will be two parts; Part A and Part B. Part A contains 5 questions with 2 questions from each module (2.5 modules x 2 = 5), having 3 marks for each question. Students should answer all questions. Part B also contains 5 questions with 2 questions from each module (2.5 modules x 2 = 5), of which a student should answer any one. The questions should not have sub-divisions and each one carries 7 marks.

**End Semester Examination Pattern:** There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which a student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

### Sample Course Level Assessment Questions

**Course Outcome 1 (CO1):** Write an algorithm to check whether largest of 3 natural numbers is prime or not. Also, draw a flowchart for solving the same problem.

**Course Outcome 2 (CO2):** Write an easy to read C program to process a set of n natural numbers and to find the largest even number and smallest odd number from the given set of numbers. The program should not use division and modulus operators.

**Course Outcome 3 (CO3):** Write an easy to read C program to process the marks obtained by n students of a class and prepare their rank list based on the sum of the marks obtained. There are 3 subjects for which examinations are conducted and the third subject is an elective where a student is allowed to take any one of the two courses offered.

**Course Outcome 4 (CO4):** Write an easy to read C program to find the value of a mathematical function f which is defined as follows.  $f(n) = n! / (\text{sum of factors of } n)$ , if n is not prime and  $f(n) = n! / (\text{sum of digits of } n)$ , if n is prime.

**Course Outcome 5 (CO5):** Write an easy to read C program to sort a set of n integers and to find the number of unique numbers and the number of repeated numbers in the given set of numbers. Use a function which takes an integer array of n elements, sorts the array using the Bubble Sorting Technique and returns the number of unique numbers and the number of repeated numbers in the given array.

**Course Outcome 6 (CO6):** Write an easy to read C program to process a text file and to print the Palindrome words into an output file.

**Model Question paper**

**QP CODE:**

**PAGES:3**

Reg No: \_\_\_\_\_

Name : \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION,  
MONTH & YEAR**

**Course Code: EST 102**

**Course Name: Programming in C (Common to all programs)**

**Max.Marks:100**

**Duration: 3 Hours**

**PART A**

**Answer all Questions. Each question carries 3 Marks**

1. Write short note on processor and memory in a computer.
2. What are the differences between compiled and interpreted languages? Give example for each.
3. Write a C program to read a Natural Number through keyboard and to display the reverse of the given number. For example, if "3214567" is given as input, the output to be shown is "7654123".
4. Is it advisable to use *goto* statements in a C program? Justify your answer.
5. Explain the different ways in which you can *declare & initialize* a single dimensional array.
6. Write a C program to read a sentence through keyboard and to display the count of white spaces in the given sentence.
7. What are the advantages of using functions in a program?
8. With a simple example program, explain *scope* and *life time* of variables in C.
9. Write a function in C which takes the address of a single dimensional array (containing a finite sequence of numbers) and the number of numbers stored in the array as arguments and stores the numbers in the same array in reverse order. Use pointers to access the elements of the array.
10. With an example, explain the different modes of opening a file. (10x3=30)

**Part B**

**Answer any one Question from each module. Each question carries 14 Marks**

11. (a) Draw a flow chart to find the position of an element in a given sequence, using linear searching technique. With an example explain how the flowchart finds the position of a given element. (10)  
(b) Write a pseudo code representing the flowchart for linear searching. (4)

**OR**

12. (a) With the help of a flow chart, explain the bubble sort operation. Illustrate with an example. (10)  
(b) Write an algorithm representing the flowchart for bubble sort. (4)

13. (a) Write a C program to read an English Alphabet through keyboard and display whether the given Alphabet is in upper case or lower case. (6)  
(b) Explain how one can use the builtin function in C, *scanf* to read values of different data types. Also explain using examples how one can use the builtin function in C, *printf* for text formatting. (8)

OR

14. (a) With suitable examples, explain various operators in C. (10)  
(b) Explain how characters are stored and processed in C. (4)

15. (a) Write a function in C which takes a 2-Dimensional array storing a matrix of numbers and the order of the matrix (number of rows and columns) as arguments and displays the sum of the elements stored in each row. (6)  
(b) Write a C program to check whether a given matrix is a diagonal matrix. (8)

OR

16. (a) Without using any builtin string processing function like *strlen*, *strcat* etc., write a program to concatenate two strings. (8)  
(b) Write a C program to perform bubble sort. (6)

17. (a) Write a function namely *myFact* in C to find the factorial of a given number. Also, write another function in C namely *nCr* which accepts two positive integer parameters *n* and *r* and returns the value of the mathematical function  $C(n,r) (n! / (r! \times (n - r)!))$ . The function *nCr* is expected to make use of the factorial function *myFact*. (10)  
(b) What is recursion? Give an example. (4)

OR

18. (a) With a suitable example, explain the differences between a structure and a union in C. (6)  
(b) Declare a structure namely *Student* to store the details (*roll number*, *name*, *mark\_for\_C*) of a student. Then, write a program in C to find the average mark obtained by the students in a class for the subject *Programming in C* (using the field *mark\_for\_C*). Use array of structures to store the required data (8)

19. (a) With a suitable example, explain the concept of pass by reference. (6)  
(b) With a suitable example, explain how pointers can help in changing the content of a single dimensionally array passed as an argument to a function in C. (8)

OR

20. (a) Differentiate between sequential files and random access files? (4)

(b) Using the prototypes explain the functionality provided by the following functions. (10)

*rewind()*

i. *fseek()*

ii. *ftell()*

iii. *fread()*

iv. *fwrite()*

(14X5=70)

## SYLLABUS

### Programming in C (Common to all disciplines)

#### Module 1

##### Basics of Computer Hardware and Software

Basics of Computer Architecture: processor, Memory, Input & Output devices

Application Software & System software: Compilers, interpreters, High level and low level languages

Introduction to structured approach to programming, Flow chart Algorithms, Pseudo code (*bubble sort, linear search - algorithms and pseudocode*)

#### Module 2

##### Program Basics

Basic structure of C program: Character set, Tokens, Identifiers in C, Variables and Data Types, Constants, Console IO Operations, printf and scanf

Operators and Expressions: Expressions and Arithmetic Operators, Relational and Logical Operators, Conditional operator, size of operator, Assignment operators and Bitwise Operators. Operators Precedence

Control Flow Statements: If Statement, Switch Statement, Unconditional Branching using goto statement, While Loop, Do While Loop, For Loop, Break and Continue statements. (Simple programs covering control flow)

#### Module 3

##### Arrays and strings

Arrays Declaration and Initialization, 1-Dimensional Array, 2-Dimensional Array

String processing: In built String handling functions (strlen, strcpy, strcat and strcmp, puts, gets)

Linear search program, bubble sort program, simple programs covering arrays and strings

#### Module 4

##### Working with functions

Introduction to modular programming, writing functions, formal parameters, actual parameters Pass by Value, Recursion, Arrays as Function Parameters structure, union, Storage Classes, Scope and life time of variables, *simple programs using functions*

## Module 5

### Pointers and Files

Basics of Pointer: declaring pointers, accessing data through pointers, NULL pointer, array access using pointers, pass by reference effect

File Operations: open, close, read, write, append

Sequential access and random access to files: In built file handling functions (*rewind()*, *fseek()*, *ftell()*, *feof()*, *fread()*, *fwrite()*), simple programs covering pointers and files.

### Text Books

1. Schaum Series, Gottfried B.S., Tata McGraw Hill, Programming with C
2. E. Balagurusamy, McGraw Hill, Programming in ANSI C
3. Asok N Kamthane, Pearson, Programming in C
4. Anita Goel, Pearson, Computer Fundamentals

### Reference Books

1. Anita Goel and Ajay Mittal, Pearson, Computer fundamentals and Programming in C
2. Brian W. Kernighan and Dennis M. Ritchie, Pearson, C Programming Language
3. Rajaraman V, PHI, Computer Basics and Programming in C
4. Yashavant P, Kanetkar, BPB Publications, Let us C

### Course Contents and Lecture Schedule

Module 1: Basics of Computer Hardware and Software		(7 hours)
1.1	<b>Basics of Computer Architecture:</b> Processor, Memory, Input & Output devices	2 hours
1.2	<b>Application Software &amp; System software:</b> Compilers, interpreters, High level and low level languages	2 hours
1.3	Introduction to structured approach to programming, Flow chart	1 hours
1.4	Algorithms, Pseudo code ( <i>bubble sort, linear search - algorithms and pseudocode</i> )	2 hours
Module 2: Program Basics		(8 hours)
2.1	<b>Basic structure of C program:</b> Character set, Tokens, Identifiers in C, Variables and Data Types, Constants, Console IO Operations, printf and scanf	2 hours
2.2	<b>Operators and Expressions:</b> Expressions and Arithmetic Operators, Relational and Logical Operators, Conditional operator, sizeof operator, Assignment operators and Bitwise Operators. Operators Precedence	2 hours

2.3	<b>Control Flow Statements:</b> If Statement, Switch Statement, Unconditional Branching using goto statement, While Loop, Do While Loop, For Loop, Break and Continue statements. <i>(Simple programs covering control flow)</i>	4 hours
<b>Module 3: Arrays and strings:</b>		<b>(6 hours)</b>
3.1	Arrays Declaration and Initialization, 1-Dimensional Array, 2-Dimensional Array	2 hours
3.2	<b>String processing:</b> In built String handling functions( <i>strlen, strcpy, strcat and strcmp, puts, gets</i> )	2 hours
3.3	Linear search program, bubble sort program, <i>simple programs covering arrays and strings</i>	3 hours
<b>Module 4: Working with functions</b>		<b>(7 hours)</b>
4.1	Introduction to modular programming, writing functions, formal parameters, actual parameters	2 hours
4.2	Pass by Value, Recursion, Arrays as Function Parameters	2 hours
4.3	structure, union, Storage Classes, Scope and life time of variables, <i>simple programs using functions</i>	3 hours
<b>Module 5: Pointers and Files</b>		<b>(7 hours)</b>
5.1	<b>Basics of Pointer:</b> declaring pointers, accessing data through pointers, NULL pointer, array access using pointers, pass by reference effect	3 hours
5.2	<b>File Operations:</b> open, close, read, write, append	1 hours
5.3	<b>Sequential access and random access to files:</b> In built file handling functions ( <i>rewind(), fseek(), ftell(), feof(), fread(), fwrite()</i> ), <i>simple programs covering pointers and files.</i>	2 hours

#### C PROGRAMMING LAB (Practical part of EST 102, Programming in C)

**Assessment Method:** The Academic Assessment for the Programming lab should be done internally by the College. The assessment shall be made on 50 marks and the mark is divided as follows: Practical Records/Outputs - 20 marks (internal by the College), Regular Lab Viva - 5 marks (internal by the College), Final Practical Exam – 25 marks (internal by the College).

**The mark obtained out of 50 will be converted into equivalent proportion out of 20 for CIE computation.**



## LIST OF LAB EXPERIMENTS

1. Familiarization of Hardware Components of a Computer
2. Familiarization of Linux environment – How to do Programming in C with Linux
3. Familiarization of console I/O and operators in C
  - i) Display “Hello World”
  - ii) Read two numbers, add them and display their sum
  - iii) Read the radius of a circle, calculate its area and display it
  - iv) Evaluate the arithmetic expression  $((a - b / c * d + e) * (f + g))$  and display its solution. Read the values of the variables from the user through console.
4. Read 3 integer values and find the largest among them.
5. Read a Natural Number and check whether the number is prime or not
6. Read a Natural Number and check whether the number is Armstrong or not
7. Read n integers, store them in an array and find their sum and average
8. Read n integers, store them in an array and search for an element in the array using an algorithm for Linear Search
9. Read n integers, store them in an array and sort the elements in the array using Bubble Sort algorithm
10. Read a string (word), store it in an array and check whether it is a palindrome word or not.
11. Read two strings (each one ending with a \$ symbol), store them in arrays and concatenate them without using library functions.
12. Read a string (ending with a \$ symbol), store it in an array and count the number of vowels, consonants and spaces in it.
13. Read two input each representing the distances between two points in the Euclidean space, store these in structure variables and add the two distance values.
14. Using structure, read and print data of n employees (*Name, Employee Id and Salary*)
15. Declare a union containing 5 string variables (*Name, House Name, City Name, State and Pin code*) each with a length of C\_SIZE (user defined constant). Then, read and display the address of a person using a variable of the union.
16. Find the factorial of a given Natural Number n using recursive and non recursive functions
17. Read a string (word), store it in an array and obtain its reverse by using a user defined function.
18. Write a menu driven program for performing matrix addition, multiplication and finding the transpose. Use functions to (i) read a matrix, (ii) find the sum of two matrices, (iii) find the product of two matrices, (iv) find the transpose of a matrix and (v) display a matrix.
19. Do the following using pointers
  - i) add two numbers
  - ii) swap two numbers using a user defined function
20. Input and Print the elements of an array using pointers
21. Compute sum of the elements stored in an array using pointers and user defined function.
22. Create a file and perform the following
  - iii) Write data to the file
  - iv) Read the data in a given file & display the file content on console
  - v) append new data and display on console
23. Open a text input file and count number of characters, words and lines in it; and store the results in an output file.





CO 7	2											
CO 8	2											

### Mark distribution

Total Marks	CIE	ESE	ESE Duration
100	70	30	1 hour

**Assessment Procedure:** Total marks allotted for the course is 100 marks. CIE shall be conducted for 70 marks and ESE for 30 marks. CIE should be done for the work done by the student and also viva voce based on the work done on each practical session. ESE shall be evaluated by written examination of one hour duration conducted internally by the institute.

### Continuous Internal Evaluation Pattern:

Attendance	: 20 marks
Class work/ Assessment/Viva-voce	: 50 marks
End semester examination (Internally by college)	: 30 marks

**End Semester Examination Pattern:** Written Objective Examination of one hour

## SYLLABUS

### PART 1

#### CIVIL WORKSHOP

- Exercise 1. Calculate the area of a built-up space and a small parcel of land- Use standard measuring tape and digital distance measuring devices
- Exercise 2. (a) Use screw gauge and vernier calliper to measure the diameter of a steel rod and thickness of a flat bar
- (b) Transfer the level from one point to another using a water level
- (c) Set out a one room building with a given plan and measuring tape
- Exercise 3. Find the level difference between any two points using dumpy level
- Exercise 4. (a) Construct a  $1\frac{1}{2}$  thick brick wall of 50 cm height and 60 cm length using English bond. Use spirit level to assess the tilt of walls.
- (b) Estimate the number of different types of building blocks to construct this wall.

- Exercise 5. (a) Introduce the students to plumbing tools, different types of pipes, type of connections, traps, valves, fixtures and sanitary fittings.
- (b) Install a small rainwater harvesting installation in the campus

**Reference Books:**

1. Khanna P.N, "Indian Practical Civil Engineering Handbook", Engineers Publishers.
2. Bhavikatti. S, "Surveying and Levelling (Volume 1)", I.K. International Publishing House
3. Arora S.P and Bindra S.P, " Building Construction", Dhanpat Rai Publications
4. S. C. Rangwala, "Engineering Materials," Charotar Publishing House.

**PART II**

**MECHANICAL WORKSHOP**

**LIST OF EXERCISES**

(Minimum EIGHT units mandatory and FIVE models from Units 2 to 8 mandatory)

UNIT 1:- General : Introduction to workshop practice, Safety precautions, Shop floor ethics, Basic First Aid knowledge.

Study of mechanical tools, components and their applications: (a) Tools: screw drivers, spanners, Allen keys, cutting pliers etc and accessories (b) bearings, seals, O-rings, circlips, keys etc.

UNIT 2:- Carpentry : Understanding of carpentry tools

Minimum any one model

1. T-Lap joint
2. Cross lap joint
3. Dovetail joint
4. Mortise joints

UNIT 3:- Foundry : Understanding of foundry tools

Minimum any one model

1. Bench Molding
2. Floor Molding
3. Core making
4. Pattern making

UNIT 4:- Sheet Metal : Understanding of sheet metal working tools

Minimum any one model

1. Cylindrical shape
2. Conical shape
3. Prismatic shaped job from sheet metal

UNIT 5:- Fitting : Understanding of tools used for fitting

Minimum any one model

1. Square Joint
2. V- Joint
3. Male and female fitting

UNIT 6:- Plumbing : Understanding of plumbing tools, pipe joints

Any one exercise on joining of pipes making use of minimum three types of pipe joints

UNIT 7:- Smithy: Understanding of tools used for smithy.

Demonstrating the forge-ability of different materials (MS, Al, alloy steel and cast steels) in cold and hot states.

Observing the qualitative difference in the hardness of these materials

Minimum any one exercise on smithy

1. Square prism
2. Hexagonal headed bolt
3. Hexagonal prism
4. Octagonal prism

UNIT 8: -Welding: Understanding of welding equipments

Minimum any one welding practice

Making Joints using electric arc welding. bead formation in horizontal, vertical and over head positions

UNIT 9: - Assembly: Demonstration only

Disassembling and assembling of

1. Cylinder and piston assembly
2. Tail stock assembly
3. Bicycle
4. Pump or any other machine

UNIT 10: - Machines: Demonstration and applications of the following machines

Shaping and slotting machine; Milling machine; Grinding Machine; Lathe; Drilling Machine.

UNIT 11: - Modern manufacturing methods: Power tools, CNC machine tools, 3D printing, Glass cutting.

**Course Contents and Lecture Schedule:**

No	Topic	No of Sessions
1	<b>INTRODUCTION</b>	
1.1	Workshop practice, shop floor precautions, ethics and First Aid knowledge. Studies of mechanical tools, components and their applications: (a) Tools: screw drivers, spanners, Allen keys, cutting pliers etc and accessories (b) bearings, seals, O-rings, circlips, keys etc	1
2	<b>CARPENTRY</b>	
2.1	Understanding of carpentry tools and making minimum one model	2

3	<b>FOUNDRY</b>	
3.1	Understanding of foundry tools and making minimum one model	2
4	<b>SHEET METAL</b>	
4.1	Understanding of sheet metal working tools and making minimum one model	2
5	<b>FITTING</b>	
5.1	Understanding of fitting tools and making minimum one model	2
6	<b>PLUMBING</b>	
6.1	Understanding of pipe joints and plumbing tools and making minimum one model	2
7	<b>SMITHY</b>	
7.1	Understanding of smithy tools and making minimum one model	2
8	<b>WELDING</b>	
8.1	Understanding of welding equipments and making minimum one model	2
9	<b>ASSEMBLY</b>	
9.1	Demonstration of assembly and dissembling of multiple parts components	1
10	<b>MACHINES</b>	
10.1	Demonstration of various machines	1
11	<b>MODERN MANUFACTURING METHODS</b>	
11.1	Demonstrations of: power tools, CNC Machine tools, 3D printing, Glass cutting	1

MAT 102	VECTOR CALCULUS, DIFFERENTIAL EQUATIONS AND TRANSFORMS	CATEGORY	L	T	P	CREDIT	Year of Introduction
		BSC	3	1	0	4	2019

**Preamble:** This course introduces the concepts and applications of differentiation and integration of vector valued functions, differential equations, Laplace and Fourier Transforms. The objective of this course is to familiarize the prospective engineers with some advanced concepts and methods in Mathematics which include the Calculus of vector valued functions, ordinary differential equations and basic transforms such as Laplace and Fourier Transforms which are invaluable for any engineer's mathematical tool box. The topics treated in this course have applications in all branches of engineering.

**Prerequisite:** Calculus of single and multi variable functions.

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

CO 1	Compute the derivatives and line integrals of vector functions and learn their applications
CO 2	Evaluate surface and volume integrals and learn their inter-relations and applications.
CO 3	Solve homogeneous and non-homogeneous linear differential equation with constant coefficients
CO 4	Compute Laplace transform and apply them to solve ODEs arising in engineering
CO 5	Determine the Fourier transforms of functions and apply them to solve problems arising in engineering

#### Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	3	3	2	1			1	2		2
CO 2	3	3	3	3	2	1			1	2		2
CO 3	3	3	3	3	2	1			1	2		2
CO 4	3	3	3	3	2	1			1	2		2
CO 5	3	3	3	3	2	1			1	2		2

#### Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination (Marks)
	Test 1 (Marks)	Test 2 (Marks)	
Remember	10	10	20
Understand	20	20	40
Apply	20	20	40
Analyse			
Evaluate			

Create			
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### Mark distribution

Total Marks	CIE (Marks)	ESE (Marks)	ESE Duration
150	50	100	3 hours

### Continuous Internal Evaluation Pattern:

Attendance : 10 marks

Continuous Assessment Test (2 numbers) : 25 marks

Assignment/Quiz/Course project : 15 marks

**Assignments:** Assignment should include specific problems highlighting the applications of the methods introduced in this course in science and engineering.

**End Semester Examination Pattern:** There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer only one. Each question can have maximum 2 sub-divisions and carry 14 marks.

### Course Level Assessment Questions

**Course Outcome 1 (CO1):** Compute the derivatives and line integrals of vector functions and learn their applications

1. How would you calculate the speed, velocity and acceleration at any instant of a particle moving in space whose position vector at time  $t$  is  $\mathbf{r}(t)$ ?
2. Find the work done by the force field  $F = (e^x - y^3)\mathbf{i} + (\cos y + x^3)\mathbf{j}$  on a particle that travels once around the unit circle centred at origin having radius 1.
3. When do you say that a vector field is conservative? What are the implications if a vector field is conservative?

**Course Outcome 2 (CO2):** Evaluate surface and volume integrals and learn their inter-relations and applications

1. Write any one application each of line integral, double integral and surface integral.
2. Use the divergence theorem to find the outward flux of the vector field  $F(x, y, z) = z\mathbf{k}$  across the

$$x^2 + y^2 + z^2 = a^2$$

3. State Greens theorem. Use Green's theorem to express the area of a plane region bounded by a curve as a line integral.

**Course Outcome 3 (CO3):** Solve homogeneous and non-homogeneous linear differential equation with constant coefficients

1. If  $y_1(x)$  and  $y_2(x)$  are solutions of  $y'' + py' + qy = 0$ , where  $p, q$  are constants, show that

$y_1(x) + y_2(x)$  is also a solution.

2. Solve the differential equation  $y'' + y = 0.001x^2$  using method of undetermined coefficient.

3. Solve the differential equation of  $y''' - 3y'' + 3y' - y = e^x - x - 1$ .

**Course Outcome 4 (CO4):** Compute Laplace transform and apply them to solve ODEs arising in engineering

1. What is the inverse Laplace Transform of  $(s) = \frac{3s-137}{s^2+2s+4}$ ?

2. Find Laplace Transform of Unit step function.

3. Solve the differential equation of  $y'' + 9y = \delta\left(t - \frac{\pi}{2}\right)$ ? Given  $y(0) = 2$ ,  $y'(0) = 0$

**Course Outcome 5 (CO5):** Determine the Fourier transforms of functions and apply them to solve problems arising in engineering

1. Find the Fourier integral representation of function defined by

$$f(x) = e^{-x} \text{ for } x > 0 \text{ and } f(x) = 0 \text{ for } x < 0.$$

2. What are the conditions for the existence of Fourier Transform of a function  $f(x)$ ?

3. Find the Fourier transform of  $f(x) = 1$  for  $|x| < 1$  and  $f(x) = 0$  otherwise.

### Model Question paper

QP CODE:

PAGES:3

Reg No: \_\_\_\_\_

Name : \_\_\_\_\_

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION,  
MONTH & YEAR

Course Code: MAT 102

Max. Marks: 100

Duration: 3 Hours

VECTOR CALCULUS, DIFFERENTIAL EQUATIONS AND TRANSFORMS

(2019-Scheme)

(Common to all branches)



## PART A

(Answer all questions. Each question carries 3 marks)

1. Is the vector  $\mathbf{r}$  where  $\mathbf{r} = x\mathbf{i} + y\mathbf{j} + z\mathbf{k}$  conservative. Justify your answer.
2. State Greens theorem including all the required hypotheses
3. What is the outward flux of  $\mathbf{F}(x, y, z) = x\mathbf{i} + y\mathbf{j} + z\mathbf{k}$  across any unit cube.
4. What is the relationship between Green's theorem and Stokes theorem?
5. Solve  $y'' + 4y' + 2.5y = 0$
6. Does the function  $y = C_1 \cos x + C_2 \sin x$  form a solution of  $y'' + y = 0$ ? Is it the general solution? Justify your answer.
7. Find the Laplace transform of  $e^{-t} \sinh 4t$
8. Find the Laplace inverse transform of  $\frac{1}{s(s^2 + \omega^2)}$ .
9. Given the Fourier transform  $\frac{1}{\sqrt{2}} e^{-\frac{\omega^2}{4}}$  of  $f(x) = e^{-x^2}$ , find the Fourier transform of  $x e^{-x^2}$
10. State the convolution theorem for Fourier transform

## PART B

(Answer one full question from each module. Each full question carries 14 marks)

### MODULE 1

11a) Prove that the force field  $\mathbf{F} = e^y \mathbf{i} + x e^y \mathbf{j}$  is conservative in the entire  $xy$ -plane

b) Use Greens theorem to find the area enclosed by the ellipse  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

12 a) Find the divergence of the vector field  $\mathbf{F} = \frac{c}{(x^2 + y^2 + z^2)^{3/2}} (x\mathbf{i} + y\mathbf{j} + z\mathbf{k})$

b) Find the work done by the force field  $\mathbf{F}(x, y, z) = xy\mathbf{i} + yz\mathbf{j} + xz\mathbf{k}$  along C where

C is the curve  $\mathbf{r}(t) = t\mathbf{i} + t^2\mathbf{j} + t^3\mathbf{k}$

### MODULE II

13 a) Use divergence theorem to find the outward flux of the vector field

$\mathbf{F} = 2x\mathbf{i} + 3y\mathbf{j} + z^3\mathbf{k}$  across the unit cube bounded by or  $x = 0, y = 0, z = 0, x = 1, y = 1, z = 1$

b) Find the circulation of  $\mathbf{F} = (x - z)\mathbf{i} + (y - x)\mathbf{j} + (z - xy)\mathbf{k}$  using Stokes theorem around the triangle with vertices  $A(1,0,0), B(0,2,0)$  and  $C(0,0,1)$

14 a) Use divergence theorem to find the volume of the cylindrical solid bounded

by  $x^2 + 4x + y^2 = 7, z = -1, z = 4$ , given the vector field  $\mathbf{F} = x\mathbf{i} + y\mathbf{j} + z\mathbf{k}$  across surface of the cylinder

b) Use Stokes theorem to evaluate  $\int_C \mathbf{F} \cdot d\mathbf{r}$  where  $\mathbf{F} = x^2\mathbf{i} + 3x\mathbf{j} - y^3\mathbf{k}$  where C is

the circle  $x^2 + y^2 = 1$  in the  $xy$ - plane with counterclockwise orientation looking down the positive  $z$ -axis

### MODULE III

- 15 a) Solve  $y'' + 4y' + 4y = x^2 + e^{-x} \cos x$   
b) Solve  $y''' - 3y'' + 3y' - y = e^x - x - 1$   
16 a) Solve  $y'''' + 3y'' + 3y' + y = 30e^{-x}$  given  $y(0) = 3, y'(0) = -3, y''(0) = -47$   
b) Using method of variation of parameters, solve  $y'' + y = \sec x$

### MODULE IV

- 17 a) Find the inverse Laplace transform of  $F(s) = \frac{2(e^{-s} - e^{-3s})}{s^2 - 4}$   
b) Solve the differential equation  $y'' + 16y = 4\delta(t - 3\pi); y(0) = 2, y'(0) = 0$  using Laplace transform  
18 a) Solve  $y'' + 3y' + 2y = f(t)$  where  $f(t) = 1$  for  $0 < t < 1$  and  $f(t) = 1$  for  $t > 1$  using Laplace transform  
b) Apply convolution theorem to find the Laplace inverse transform of  $\frac{1}{s^2(s^2 + \omega^2)}$

### MODULE V

- 19 a) Find the Fourier cosine integral representation for  $f(x) = e^{-kx}$  for  $x > 0$  and  $k > 0$  and hence evaluate  $\int_0^\infty \frac{\cos wx}{k^2 + w^2}$  the function  
b) Does the Fourier sine transform  $f(x) = x^{-1} \sin x$  for  $0 < x < \infty$  exist? Justify your answer  
20 a) Find the Fourier transform of  $f(x) = |x|$  for  $|x| < 1$  and  $f(x) = 0$  otherwise  
b) Find the Fourier cosine transform of  $f(x) = e^{-ax}$  for  $a > 0$

## Syllabus

### Module 1 (Calculus of vector functions)

**(Text 1: Relevant topics from sections 12.1, 12.2, 12.6, 13.6, 15.1, 15.2, 15.3)**

Vector valued function of single variable, derivative of vector function and geometrical interpretation, motion along a curve-velocity, speed and acceleration. Concept of scalar and vector fields, Gradient and its properties, directional derivative, divergence and curl, Line integrals of vector fields, work as line integral, Conservative vector fields, independence of path and potential function (results without proof).

### Module 2 ( Vector integral theorems)

**(Text 1: Relevant topics from sections 15.4, 15.5, 15.6, 15.7, 15.8)**

Green's theorem (for simply connected domains, without proof) and applications to evaluating line integrals and finding areas. Surface integrals over surfaces of the form  $z = g(x, y)$ ,  $y = g(x, z)$  or  $x = g(y, z)$ , Flux integrals over surfaces of the form  $z = g(x, y)$ ,  $y = g(x, z)$  or  $x = g(y, z)$ , divergence theorem (without proof) and its applications to finding flux integrals, Stokes' theorem (without proof) and its applications to finding line integrals of vector fields and work done.

### Module- 3 ( Ordinary differential equations)

**(Text 2: Relevant topics from sections 2.1, 2.2, 2.5, 2.6, 2.7, 2.10, 3.1, 3.2, 3.3)**

Homogenous linear differential equation of second order, superposition principle, general solution, homogenous linear ODEs with constant coefficients-general solution. Solution of Euler-Cauchy equations (second order only). Existence and uniqueness (without proof). Non homogenous linear ODEs-general solution, solution by the method of undetermined coefficients (for the right hand side of the form  $x^n, e^{kx}, \sin ax, \cos ax, e^{kx} \sin ax, e^{kx} \cos ax$  and their linear combinations), methods of variation of parameters. Solution of higher order equations-homogeneous and non-homogeneous with constant coefficient using method of undetermined coefficient.

### Module- 4 (Laplace transforms)

**(Text 2: Relevant topics from sections 6.1, 6.2, 6.3, 6.4, 6.5)**

Laplace Transform and its inverse, Existence theorem (without proof), linearity, Laplace transform of basic functions, first shifting theorem, Laplace transform of derivatives and integrals, solution of differential equations using Laplace transform, Unit step function, Second shifting theorems. Dirac delta function and its Laplace transform, Solution of ordinary differential equation involving unit step function and Dirac delta functions. Convolution theorem (without proof) and its application to finding inverse Laplace transform of products of functions.

## Module-5 (Fourier Transforms)

### (Text 2: Relevant topics from sections 11.7,11.8, 11.9)

Fourier integral representation, Fourier sine and cosine integrals. Fourier sine and cosine transforms, inverse sine and cosine transform. Fourier transform and inverse Fourier transform, basic properties. The Fourier transform of derivatives. Convolution theorem (without proof)

#### Text Books

1. H. Anton, I. Biven S.Davis, "Calculus", Wiley, 10<sup>th</sup> edition, 2015.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley, 10<sup>th</sup> edition, 2015.

#### Reference Books

1. J. Stewart, Essential Calculus, Cengage, 2<sup>nd</sup> edition, 2017
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9<sup>th</sup> Edition, Pearson, Reprint, 2002.
3. Peter O Neil, Advanced Engineering Mathematics, 7<sup>th</sup> Edition, Thomson, 2007.
4. Louis C Barret, C Ray Wylie, "Advanced Engineering Mathematics", Tata McGraw Hill, 6<sup>th</sup> edition, 2003.
5. VeerarajanT."Engineering Mathematics for first year", Tata McGraw - Hill, 2008.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36<sup>th</sup> edition , 2010.
7. Srimanta Pal, Subodh C. Bhunia, "Engineering Mathematics", Oxford University Press, 2015.
8. Ronald N. Bracewell, "The Fourier Transform and its Applications", McGraw – Hill International Editions, 2000.

#### Course Contents and Lecture Schedule

No	Topic	No. of Lectures
<b>1</b>	<b>Calculus of vector functions (9 hours)</b>	
1.1	Vector valued function of a scalar variable - derivative of vector valued function of scalar variable t-geometrical meaning	2
1.2	Motion along a curve-speed , velocity, acceleration	1
1.3	Gradient and its properties, directional derivative , divergent and curl	3
1.4	Line integrals with respect to arc length, line integrals of vector fields. Work done as line integral	2
1.5	Conservative vector field, independence of path, potential function	1

<b>2</b>	<b>Vector integral theorems( 9 hours)</b>	
2.1	Green's theorem and it's applications	2
2.2	Surface integrals , flux integral and their evaluation	3
2.3	Divergence theorem and applications	2
2.4	Stokes theorem and applications	2
<b>3</b>	<b>Ordinary Differential Equations (9 hours)</b>	
3.1	Homogenous linear equation of second order, Superposition principle, general solution	1
3.2	Homogenous linear ODEs of second order with constant coefficients	2
3.3	Second order Euler-Cauchy equation	1
3.4	Non homogenous linear differential equations of second order with constant coefficient-solution by undetermined coefficients, variation of parameters.	3
3.5	Higher order equations with constant coefficients	2
<b>4</b>	<b>Laplace Transform (10 hours)</b>	
4.1	Laplace Transform , inverse Transform, Linearity, First shifting theorem, transform of basic functions	2
4.2	Transform of derivatives and integrals	1
4.3	Solution of Differential equations, Initial value problems by Laplace transform method.	2
4.4	Unit step function --- Second shifting theorem	2
4.5	Dirac Delta function and solution of ODE involving Dirac delta function	2
4.6	Convolution and related problems.	1
<b>5</b>	<b>Fourier Transform (8 hours)</b>	
5.1	Fourier integral representation	1
5.2	Fourier Cosine and Sine integrals and transforms	2
5.3	Complex Fourier integral representation, Fourier transform and its inverse transforms, basic properties	3
5.4	Fourier transform of derivatives, Convolution theorem	2

AL-ARIFU KAIAM  
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UNIVERSITY

KU



ESL 130	ELECTRICAL & ELECTRONICS WORKSHOP	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		ESC	0	0	2	1	2019

**Preamble:** Electrical Workshop is intended to impart skills to plan and carry out simple electrical wiring. It is essential for the practicing engineers to identify the basic practices and safety measures in electrical wiring.

**Prerequisite:** NIL

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

CO 1	Demonstrate safety measures against electric shocks.
CO 2	Identify the tools used for electrical wiring, electrical accessories, wires, cables, batteries and standard symbols
CO 3	Develop the connection diagram, identify the suitable accessories and materials necessary for wiring simple lighting circuits for domestic buildings
CO 4	Identify and test various electronic components
CO 5	Draw circuit schematics with EDA tools
CO 6	Assemble and test electronic circuits on boards
CO 7	Work in a team with good interpersonal skills

#### Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	-	-	-	-	-	3	-	-	-	-	-	1
CO 2	2	-	-	-	-	-	-	-	-	1	-	-
CO 3	2	-	-	1	-	1	-	1	2	2	-	2
CO 4	3	-	-	-	-	-	-	-	-	-	-	2
CO 5	3	-	-	-	2	-	-	-	-	-	-	2
CO 6	3	-	-	-	2	-	-	-	-	-	-	1
CO 7	-	-	-	-	-	-	-	-	3	2	-	2

#### Mark distribution

Total Marks	CIE	ESE	ESE Duration(Internal)
100	100	-	1 hour

**Continuous Internal Evaluation Pattern:**

Attendance	: 20 marks
Class work/ Assessment/Viva-voce	: 50 marks
End semester examination (Internally by college)	: 30 marks

**End Semester Examination Pattern:** Written Objective Examination of one hour

**Syllabus**

**PART 1**

**ELECTRICAL**

**List of Exercises / Experiments**

1. a) Demonstrate the precautionary steps adopted in case of Electrical shocks.  
b) Identify different types of cables, wires, switches, fuses, fuse carriers, MCB, ELCB and MCCB with ratings.
2. Wiring of simple light circuit for controlling light/ fan point (PVC conduit wiring)
3. Wiring of light/fan circuit using Two way switches . (Staircase wiring)
4. Wiring of Fluorescent lamps and light sockets (6A) with a power circuit for controlling power device. (16A socket)
5. Wiring of power distribution arrangement using single phase MCB distribution board with ELCB, main switch and Energy meter.
6. a) Identify different types of batteries with their specifications.  
b) Demonstrate the Pipe and Plate Earthing Schemes using Charts/Site Visit.

**PART II**

**ELECTRONICS**

**List of Exercises / Experiments (Minimum of 7 mandatory)**

1. Familiarization/Identification of electronic components with specification (Functionality, type, size, colour coding, package, symbol, cost etc. [Active, Passive, Electrical, Electronic, Electro-mechanical, Wires, Cables, Connectors, Fuses, Switches, Relays, Crystals, Displays, Fasteners, Heat sink etc.]



2. Drawing of electronic circuit diagrams using BIS/IEEE symbols and introduction to EDA tools (such as Dia or Xcircuit), Interpret data sheets of discrete components and IC's, Estimation and costing.
3. Familiarization/Application of testing instruments and commonly used tools. [Multimeter, Function generator, Power supply, DSO etc.] [Soldering iron, De-soldering pump, Pliers, Cutters, Wire strippers, Screw drivers, Tweezers, Crimping tool, Hot air soldering and de-soldering station etc.]
4. Testing of electronic components [Resistor, Capacitor, Diode, Transistor and JFET using multimeter.]
5. Inter-connection methods and soldering practice. [Bread board, Wrapping, Crimping, Soldering - types - selection of materials and safety precautions, soldering practice in connectors and general purpose PCB, Crimping.]
6. Printed circuit boards (PCB) [Types, Single sided, Double sided, PTH, Processing methods, Design and fabrication of a single sided PCB for a simple circuit with manual etching (Ferric chloride) and drilling.]
7. Assembling of electronic circuits using SMT (Surface Mount Technology) stations.
8. Assembling of electronic circuit/system on general purpose PCB, test and show the functioning (**Any Two circuits**).
  1. Fixed voltage power supply with transformer, rectifier diode, capacitor filter, zener/IC regulator.
  2. Square wave generation using IC 555 timer in IC base.
  3. Sine wave generation using IC 741 OP-AMP in IC base.
  4. RC coupled amplifier with transistor BC107.

EST 110	ENGINEERING GRAPHICS	CATEGORY	L	T	P	CREDIT	Year of Introduction
		ESC	2	0	2	3	2019

**Preamble:** To enable the student to effectively perform technical communication through graphical representation as per global standards.

**Prerequisite:** NIL

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

CO 1	Draw the projection of points and lines located in different quadrants
CO 2	Prepare multiview orthographic projections of objects by visualizing them in different positions
CO 3	Draw sectional views and develop surfaces of a given object
CO 4	Prepare pictorial drawings using the principles of isometric and perspective projections to visualize objects in three dimensions.
CO 5	Convert 3D views to orthographic views
CO 6	Obtain multiview projections and solid models of objects using CAD tools

**Mapping of course outcomes with program outcomes**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3											
CO 2	3											
CO 3	3	1										
CO 4	3									1		
CO 5	3									2		
CO 6	3				3					3		

**Assessment Pattern**

Bloom's Category	Continuous Assessment Tests		End Semester Examination (100 Marks)
	Test 1 (15 Marks)	Test 2 (15 Marks)	
Remember			
Understand	5		20
Apply	10	10	80
Analyse			
Evaluate			
Create			

### Mark distribution

Total Marks	CIE (Marks)	ESE (Marks)	ESE Duration
150	50	100	3 hours

### Continuous Internal Evaluation Pattern:

Attendance : 10 marks

CIA for section A carries 25 marks (15 marks for 1 test and Class work 10 marks)

CIA for section B carries 15 marks (10 marks for 1 test and Class work 5 marks)

### End Semester Examination Pattern:

ESE will be of 3 hour duration on A4 size answer booklet and will be for 100 marks. The question paper shall contain two questions from each module of Section A only. Student has to answer any one question from each module. Each question carries 20 marks.

### Course Level Assessment Questions

(Questions may be framed based on the outline given under each course outcome)

#### Course Outcome 1 (CO1):

1. Locate points in different quadrants as per given conditions.
2. Problems on lines inclined to both planes .
3. Find True length, Inclinations and Traces of lines.

#### Course Outcome 2 (CO2)

1. Draw orthographic views of solids and combination solids
2. Draw views of solids inclined to any one reference plane.
3. Draw views of solids inclined to both reference planes.

#### Course Outcome 3 (CO3):

1. Draw views of solids sectioned by a cutting plane
2. Find location and inclination of cutting plane given true shape of the section
3. Draw development of lateral surface of solids and also its sectioned views

#### Course Outcome 4 (CO4):

1. Draw Isometric views/projections of solids
2. Draw Isometric views/projections of combination of solids
3. Draw Perspective views of Solids

#### Course Outcome 5 (CO5):

1. Draw Orthographic views of solids from given three dimensional view

**Course Outcome 6 (CO6):**

1. Draw the given figure including dimensions using 2D software
2. Create 3D model using modelling software from the given orthographic views or 3D figure or from real 3D objects

**Model Question paper**

**QP CODE:**

**PAGES:3**

Reg No: \_\_\_\_\_

Name : \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION,  
MONTH & YEAR**

**Course Code: EST 110**

**ENGINEERING GRAPHICS**

**Max.Marks:100**

**Duration: 3 Hours**

**PART A**

**Answer all Questions. Each question carries 3 Marks**

**Instructions: Retain necessary Construction lines**

**Show necessary dimensions**

**Answer any ONE question from each module**

**Each question carries 20 marks**

**MODULE I**

1. The end point A of a line is 20mm above HP and 10mm in front of VP. The other end of the line is 50mm above HP and 15mm behind VP. The distance between the end projectors is 70mm. Draw the projections of the line. Find the true length and true inclinations of the line with the principal planes. Also locate the traces of the line.
2. One end of a line is 20mm from both the principal planes of projection. The other end of the line is 50mm above HP and 40mm in front of VP. The true length of the line is 70mm. Draw the projections of the line. Find its apparent inclinations, elevation length and plan length. Also locate its traces.

**MODULE II**

3. A pentagonal pyramid of base side 25mm and height 40mm, is resting on the ground on one of its triangular faces. The base edge of that face is inclined  $30^\circ$  to VP. Draw the projections of the solid.

- A hexagonal prism has side 25mm and height 50mm has a corner of its base on the ground and the long edge containing that corner inclined at  $30^\circ$  to HP and  $45^\circ$  to VP. Draw the projections of the solid.

### MODULE III

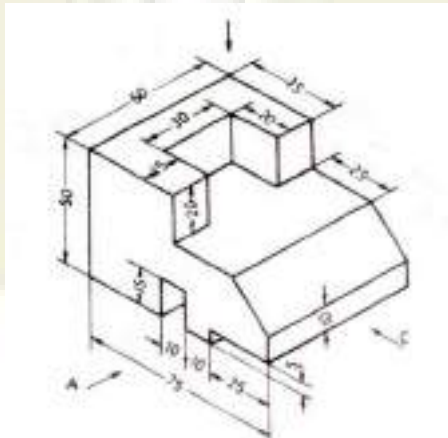
- A triangular prism of base side 40mm and height 70mm is resting with its base on the ground and having an edge of the base perpendicular to VP. Section the solid such that the true shape of the section is a trapezium of parallel sides 30mm and 10mm. Draw the projections showing the true shape. Find the inclination of the cutting plane with the ground plane.
- Draw the development of a pentagonal pyramid of base side 30mm and height 50mm. A string is wound from a corner of the base round the pyramid and back to the same point through the shortest distance. Show the position of the string in the elevation and plan.

### MODULE IV

- The frustum of a cone has base diameter 50mm and top diameter 40mm has a height of 60mm. It is placed centrally on top of a rectangular slab of size 80x60mm and of thickness 20mm. Draw the isometric view of the combination.
- A hexagonal prism has base side 35mm and height 60mm. A sphere of diameter 40mm is placed centrally on top of it. Draw the isometric projection of the combination.

### MODULE V

- Draw the perspective view of a pentagonal prism, 20mm side and 45mm long lying on one of its rectangular faces on the ground and having its axis perpendicular to picture plane. One of its pentagonal faces touches the picture plane and the station point is 50mm in front of PP, 25mm above the ground plane and lies in a central plane, which is 70mm to the left of the center of the prism.
- Draw three orthographic views with dimensions of the object shown in figure below.



(20X5=100)

**SCHEME OF VALUATION**

1. Locating the points and drawing the projections of the line – 4 marks  
Finding true length by any one method – 6 marks  
Finding true inclination with VP – 2 marks  
Finding true inclination with HP – 2 marks  
Locating horizontal trace – 2 marks  
Locating vertical trace – 2 marks  
Dimensioning and neatness – 2 marks  

Total = 20 marks
2. Locating the points and drawing true length of the line – 4 marks  
Finding projections by any method – 6 marks  
Finding length of elevation and plan – 2 marks  
Finding apparent inclinations – 2 marks  
Locating horizontal trace – 2 marks  
Locating vertical trace – 2 marks  
Dimensioning and neatness – 2 marks  

Total = 20 marks
3. Drawing initial position plan and elevation – 4 marks  
First inclination views – 4 marks  
Second inclination views -8 marks  
Marking invisible edges – 2 marks  
Dimensioning and neatness – 2 marks  

Total = 20 marks

*(Any one method or combination of methods for solving can be used.  
If initial position is wrong then maximum 50% marks may be allotted for the answer)*
4. Drawing initial position plan and elevation – 4 marks  
First inclination views – 4 marks  
Second inclination views -8 marks  
Marking invisible edges – 2 marks  
Dimensioning and neatness – 2 marks  

Total = 20 marks

*(Any one method or combination of methods for solving can be used  
If initial position is wrong then maximum 50% marks may be allotted for the answer)*
5. Drawing initial position plan and elevation – 4 marks  
Locating section plane as per given condition – 5 marks  
Drawing true shape -5 marks  
Finding inclination of cutting plane – 2 marks  
Dimensioning and neatness – 2 marks  

Total = 20 marks
6. Drawing initial position plan and elevation – 4 marks  
Development of the pyramid – 6 marks

- Locating string in development -2 marks
- Locating string in elevation – 3 marks
- Locating string in plan – 3 marks
- Dimensioning and neatness – 2 marks

Total = 20 marks

- 7. Drawing initial positions – 4 marks
- Isometric View of Slab -6 marks
- Isometric View of Frustum – 10 marks
- Dimensioning and neatness – 2 marks

Total = 20 marks

*(Initial position is optional, hence redistribute if needed.  
Reduce 4 marks if Isometric scale is taken)*

- 8. Drawing initial positions – 4 marks
- Isometric scale – 4 marks
- Isometric projection of prism -5 marks
- Isometric projection of sphere – 5 marks
- Dimensioning and neatness – 2 marks

Total = 20 marks

*(Initial position is optional, hence redistribute if needed.)*

- 9. Drawing the planes and locating the station point – 4 marks
- Locating elevation points – 2 marks
- Locating plan points – 2 marks
- Drawing the perspective view – 10 marks
- Dimensioning and neatness – 2 marks

Total = 20 marks

- 10. Drawing the elevation – 8marks
- Drawing the plan – 4 marks
- Drawing the side view – 4 marks
- Marking invisible edges – 2 marks
- Dimensioning and neatness – 2 marks

Total = 20 marks

## SYLLABUS

General Instructions:

- First angle projection to be followed
- Section A practice problems to be performed on A4 size sheets
- Section B classes to be conducted on CAD lab

### SECTION A

#### Module 1

Introduction : Relevance of technical drawing in engineering field. Types of lines, Dimensioning, BIS code of practice for technical drawing.

Orthographic projection of Points and Lines: Projection of points in different quadrants, Projection of straight lines inclined to one plane and inclined to both planes. Trace of line. Inclination of lines with reference planes True length of line inclined to both the reference planes.

#### Module 2

Orthographic projection of Solids: Projection of Simple solids such as Triangular, Rectangle, Square, Pentagonal and Hexagonal Prisms, Pyramids, Cone and Cylinder. Projection of solids in simple position including profile view. Projection of solids with axis inclined to one of the reference planes and with axis inclined to both reference planes.

#### Module 3

Sections of Solids: Sections of Prisms, Pyramids, Cone, Cylinder with axis in vertical position and cut by different section planes. True shape of the sections. Also locating the section plane when the true shape of the section is given.

Development of Surfaces: Development of surfaces of the above solids and solids cut by different section planes. Also finding the shortest distance between two points on the surface.

#### Module 4

Isometric Projection: Isometric View and Projections of Prisms, Pyramids, Cone , Cylinder, Frustum of Pyramid, Frustum of Cone, Sphere, Hemisphere and their combinations.

#### Module 5

Perspective Projection: Perspective projection of Prisms and Pyramids with axis perpendicular to the ground plane, axis perpendicular to picture plane.

Conversion of Pictorial Views: Conversion of pictorial views into orthographic views.

### SECTION B

*(To be conducted in CAD Lab)*

Introduction to Computer Aided Drawing: Role of CAD in design and development of new products, Advantages of CAD. Creating two dimensional drawing with dimensions using suitable software. (Minimum 2 exercises mandatory)

Introduction to Solid Modelling: Creating 3D models of various components using suitable modelling software. (Minimum 2 exercises mandatory)



**Text Books**

1. Bhatt, N.D., Engineering Drawing, Charotar Publishing House Pvt. Ltd.
2. John, K.C. Engineering Graphics, Prentice Hall India Publishers.

**Reference Books**

1. Anilkumar, K.N., Engineering Graphics, Adhyuth narayan Publishers
2. Agrawal, B. And Agrawal, C.M., Engineering Darwing, Tata McGraw Hill Publishers.
3. Benjamin, J., Engineering Graphics, Pentex Publishers- 3<sup>rd</sup> Edition, 2017
4. Duff, J.M. and Ross, W.A., Engineering Design and Visualisation, Cengage Learning.
5. Kulkarni, D.M., Rastogi, A.P. and Sarkar, A.K., Engineering Graphics with AutoCAD, PHI.
6. Luzaddff, W.J. and Duff, J.M., Fundamentals of Engineering Drawing, PHI.
7. Varghese, P.I., Engineering Graphics, V I P Publishers
8. Venugopal, K., Engineering Drawing and Graphics, New Age International Publishers.

**Course Contents and Lecture Schedule**

No	SECTION A	No. of Hours
1	<b>MODULE I</b>	
1.1	Introduction to graphics, types of lines, Dimensioning	1
1.2	Concept of principle planes of projection, different quadrants, locating points on different quadrants	2
1.3	Projection of lines, inclined to one plane. Lines inclined to both planes, trapezoid method of solving problems on lines.	2
1.4	Problems on lines using trapezoid method	2
1.5	Line rotation method of solving, problems on line rotation method	2
2	<b>MODULE II</b>	
2.1	Introduction of different solids, Simple position plan and elevation of solids	2
2.2	Problems on views of solids inclined to one plane	2
2.3	Problems on views of solids inclined to both planes	2
2.4	Practice problems on solids inclined to both planes	2

3	<b>MODULE III</b>	
3.1	Introduction to section planes. AIP and AVP. Principle of locating cutting points and finding true shape	2
3.2	Problems on sections of different solids	2
3.3	Problems when the true shape is given	2
3.4	Principle of development of solids, sectioned solids	2
4	<b>MODULE IV</b>	
4.1	Principle of Isometric View and Projection, Isometric Scale. Problems on simple solids	2
4.2	Isometric problems on Frustum of solids, Sphere and Hemisphere	2
4.3	Problems on combination of different solids	2
5	<b>MODULE V</b>	
5.1	Introduction to perspective projection, different planes, station point etc. Perspective problems on pyramids	2
5.2	Perspective problems on prisms	2
5.3	Practice on conversion of pictorial views into orthographic views	2
	<b>SECTION B (To be conducted in CAD lab)</b>	
1	Introduction to CAD and software. Familiarising features of 2D software. Practice on making 2D drawings	2
2	Practice session on 2D drafting	2
3	Introduction to solid modelling and software	2
4	Practice session on 3D modelling	2

EST 100	ENGINEERING MECHANICS	CATEGORY	L	T	P	CREDIT	Year of Introduction
		ESC	2	1	0	3	2019

**Preamble:** Goal of this course is to expose the students to the fundamental concepts of mechanics and enhance their problem-solving skills. It introduces students to the influence of applied force system and the geometrical properties of the rigid bodies while stationary or in motion. After this course students will be able to recognize similar problems in real-world situations and respond accordingly.

**Prerequisite:** Nil

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

CO 1	Recall principles and theorems related to rigid body mechanics
CO 2	Identify and describe the components of system of forces acting on the rigid body
CO 3	Apply the conditions of equilibrium to various practical problems involving different force system.
CO 4	Choose appropriate theorems, principles or formulae to solve problems of mechanics.
CO 5	Solve problems involving rigid bodies, applying the properties of distributed areas and masses

**Mapping of course outcomes with program outcomes (Minimum requirement)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	2	-	-	-	-	-	-	-	-	-	-
CO 2	3	3	-	-	-	-	-	-	-	-	-	-
CO 3	3	3	-	-	-	-	-	-	-	-	-	-
CO 4	3	3	-	-	-	-	-	-	-	-	-	-
CO 5	3	3	-	-	-	-	-	-	-	-	-	-

**Assessment Pattern**

Bloom's Category	Continuous Assessment Tests		End Semester Examination (Marks)
	Test 1 (Marks)	Test 2 (Marks)	
Remember	10	10	15
Understand	10	10	15
Apply	30	30	70
Analyse			
Evaluate			
Create			

### Mark distribution

Total Marks	CIE marks	ESE marks	ESE Duration
150	50	100	3 hours

#### Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

**End Semester Examination Pattern:** There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

#### Course Level Assessment Questions:

##### Part A

**Course Outcome 1 (CO1):** (One question from each module to meet the course objective 1: *To recall principles and theorems related to rigid body mechanics*)

1. Explain D'Alembert's principle
2. Distinguish static and dynamic friction
3. State and explain perpendicular axis theorem

**Course Outcome 2 (CO2)** (One question from each module to meet the course objective 2: *To identify and describe the components of system of forces acting on the rigid body*)

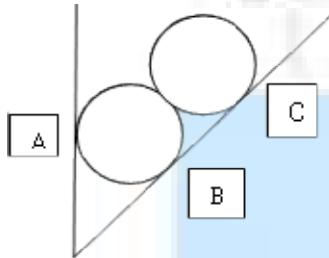
1. A simply supported beam AB of span 5 m is carrying point loads 5 kN, 3 kN and 2 kN at 1m, 3m and 4m respectively from support A. Calculate the support reaction at B.
2. A gymnast holding onto a bar, is suspended motionless in mid-air. The bar is supported by two ropes that attach to the ceiling. Diagram the forces acting on the combination of gymnast and bar
3. While you are riding your bike, you turn a corner following a circular arc. Illustrate the forces that act on your bike to keep you along the circular path ?

##### Part B

All the questions under this section shall assess the learning levels corresponding to the course outcomes listed below.

<b>CO 3</b>	To apply the conditions of equilibrium to various practical problems involving different force system.
<b>CO 4</b>	To choose appropriate theorems, principles or formulae to solve problems of mechanics.
<b>CO 5</b>	To solve problems involving rigid bodies, applying the properties of distributed areas and masses

1. Two rollers each of weight 100 N are supported by an inclined plane and a vertical wall. Find the reaction at the points of contact A, B, C. Assume all the surfaces to be smooth.

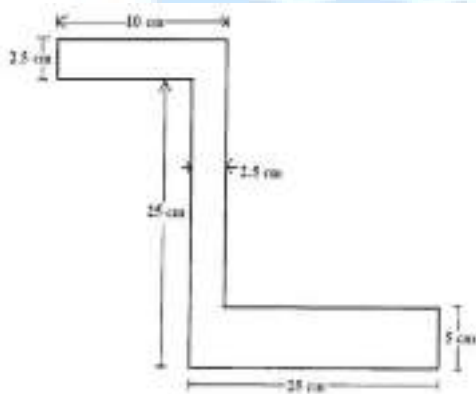


<b>Course outcome identifier</b>	<b>Description of course outcome</b>	<b>Learning level assessed</b>	<b>Marks allocated</b>
<b>CO 3</b>	To apply the conditions of equilibrium to various practical problems involving different force system.	Applying – (Sketch the free body diagram that represent equilibrium state of the body )	4
<b>CO 4</b>	To choose appropriate theorems, principles or formulae to solve problems of mechanics.	Applying (Choose the equations and formulae required for calculation)	4
<b>CO 5</b>	To solve problems involving rigid bodies, applying the properties of distributed areas and masses	Applying ( Solve the problem based on the descriptions given in CO3 and CO4)	6
<b>Total</b>			<b>14</b>

2. A cylindrical disc, 50 cm diameter and cm thickness, is in contact with a horizontal conveyor belts running at uniform speeds of 5 m/s. Assuming there is no slip at points of contact determine (i) angular velocity of disc (ii) Angular acceleration of disc if velocity of conveyor changes to 8 m/s. Also compute the moment acting about the axis of the disc in both cases.

Course outcome identifier	Description of course outcome	Learning level assessed	Marks allocated
CO 3	To apply the conditions of equilibrium to various practical problems involving different force system.	Applying – (Sketch the free body diagram that represent state of the body )	4
CO 4	To choose appropriate theorems, principles or formulae to solve problems of mechanics.	Applying (Choose the equations and formulae required for calculation)	4
CO 5	To solve problems involving rigid bodies, applying the properties of distributed areas and masses	Applying ( Solve the problem based on the descriptions given in CO3 and CO4)	6
Total			14

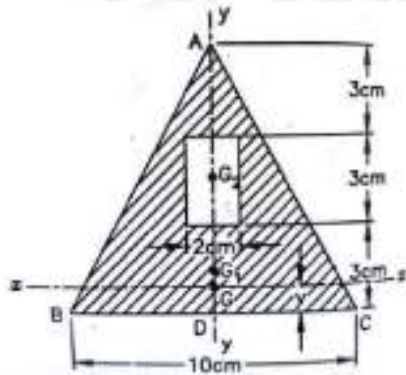
3. Determine the centroid of the given section



Course outcome identifier	Description of course outcome	Learning level assessed	Marks allocated
CO 3	To apply the conditions of equilibrium to various practical problems involving different force system.	Applying – (Illustrate the computation of centroid for the given geometrical shape)	4
CO 4	To choose appropriate theorems, principles or formulae to solve problems of mechanics.	Applying (Choose the equations and formulae required for calculation)	4
CO 5	To solve problems involving rigid bodies, applying the properties of distributed	Applying ( Solve the problem based on the descriptions	6

	areas and masses	given in CO3 and CO4)	
Total			14

4. A rectangular hole is made in a triangular section as shown. Find moment of inertia about the section x-x passing through the CG of the section and parallel to BC.



Course outcome identifier	Description of course outcome	Learning level assessed	Marks allocated
CO 3	To apply the conditions of equilibrium to various practical problems involving different force system.	Applying – (Illustrate the computation of moment of inertia for the given geometrical shape)	4
CO 4	To choose appropriate theorems, principles or formulae to solve problems of mechanics.	Applying (Choose the equations and formulae required for calculation)	4
CO 5	To solve problems involving rigid bodies, applying the properties of distributed areas and masses	Applying ( Solve the problem based on the descriptions given in CO3 and CO4)	6
Total			14

## Model Question Paper

QP CODE:

Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION,  
MONTH & YEAR

Course Code: EST 100

ENGINEERING MECHANICS

Max. Marks: 100

Duration: 3 hours

### Part A

(Answer all questions; each question carries 3 marks)

1. Explain D'Alembert's principle
2. Distinguish static and dynamic friction.
3. State and explain perpendicular axis theorem.
4. A simply supported beam AB of span 5 m is carrying point loads 5 kN, 3 kN and 2 kN at 1m, 3m and 4m respectively from support A. Calculate the support reaction at B.
5. A gymnast holding onto a bar, is suspended motionless in mid-air. The bar is supported by two ropes that attach to the ceiling. Diagram the forces acting on the combination of gymnast and bar
6. While you are riding your bike, you turn a corner following a circular arc. Illustrate the forces that act on your bike to keep you along the circular path ?
7. Compare damped and undamped free vibrations.
8. State the equation of motion of a rotating rigid body, rotating about its fixed axis.
9. Illustrate the significance of instantaneous centre in the analysis of rigid body undergoing rotational motion.
10. Highlight the principles of mechanics applied in the evaluation of elastic collision of rigid bodies.

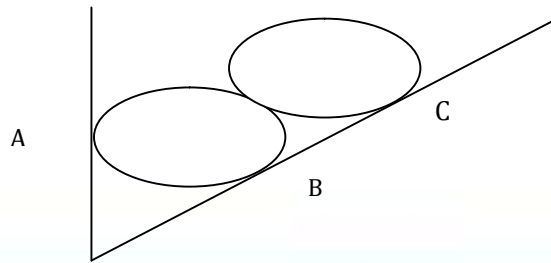
### PART B

(Answer **one full** question from each module, each question carries **14** marks)

#### Module -I

11. Two identical rollers each of weight 100 N are supported by an inclined plane, making an angle of  $30^\circ$  with the vertical, and a vertical wall. Find the reaction at the points of contact A, B, C. Assume all the surfaces to be smooth. (14 marks)

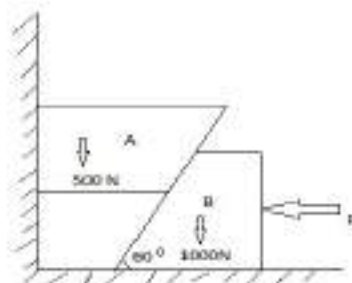




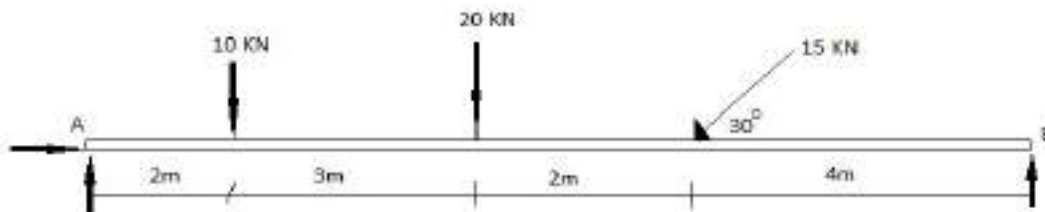
12. A string tied to a wall is made to pass over a pulley placed 2m away from it. A weight P is attached to the string such that the string stretches by 2m from the support on the wall to the location of attachment of weight. Determine the force P required to maintain 200 kg body in position for  $\theta = 30^\circ$ , The diameter of pulley B is negligible. (14 marks)

### Module – 2

13. Two blocks A & B are resting against a wall and the floor as shown in figure below. Find the value of horizontal force P applied to the lower block that will hold the system in equilibrium. Coefficient of friction are : 0.25 at the floor, 0.3 at the wall and 0.2 between the blocks. (14 marks)

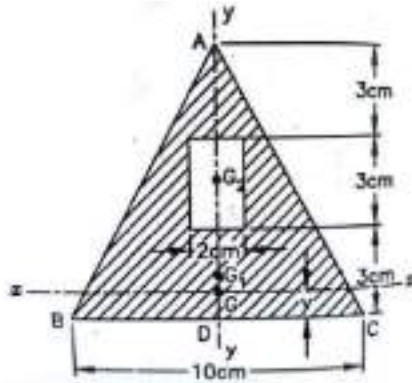


14. A beam is hinged at A and roller supported at B. It is acted upon by loads as shown below. Find the reactions at A & B. (14 marks)

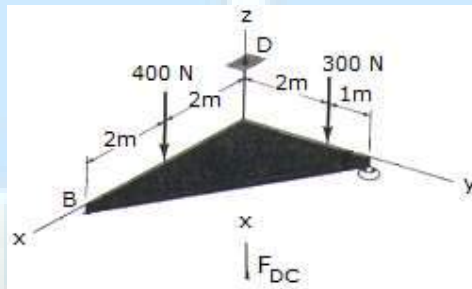


### Module – 3

15. A rectangular hole is made in a triangular section as shown. Find moment of inertia about the section x-x passing through the CG of the section and parallel to BC. (14 marks)



16. Support A has ball and socket connection. Roller support at B prevents motion in the  $-z$  direction. Corner C is tied to D by a rope. The triangle is weightless. Determine the unknown force components acting at A, B, and C. (14 marks)



#### Module - 4

17. A cricket ball is thrown by a fielder from a height of 2m at an angle of  $30^\circ$  to the horizontal with an initial velocity of 20 m/s, hits the wickets at a height of 0.5 m from the ground. How far was the fielder from the wicket? (14 marks)

18. An engine of weight 500 kN pull a train weighing 1500 kN up an incline of 1 in 100. The train starts from rest and moves with constant acceleration against a resistance of 5 N/kN. It attains a maximum speed of 36 kmph in 1 km distance. Determine the tension in the coupling between train and engine and the traction force developed by the engine. (14marks)

#### Module - 5

19. A cylindrical disc, 50 cm diameter and 10 cm thickness having mass of 10 kg, is in contact with a horizontal conveyor belt running at uniform speeds of 5 m/s. Assuming there is no slip at points of contact determine (i) angular velocity of disc (ii) Angular acceleration of disc if velocity of conveyor changes to 8 m/s in 10 seconds. Also compute the moment acting about the axis of the disc in both cases. (14 marks)

20. A wheel rotating about fixed axis at 20 rpm is uniformly accelerated for 70 seconds during which time it makes 50 revolutions. Find the (i) angular velocity at the end of this interval and (ii) time required for the velocity to reach 100 revolutions per minute. (14 marks)

## SYLLABUS

### Module 1

Introduction to Engineering Mechanics-statics-basic principles of statics-Parallelogram law, equilibrium law, principles of superposition and transmissibility, law of action and reaction(review) free body diagrams.

Concurrent coplanar forces-composition and resolution of forces-resultant and equilibrium equations – methods of projections – methods of moments – Varignon's Theorem of moments.

### Module 2

Friction – sliding friction - Coulomb's laws of friction – analysis of single bodies –wedges, ladder-analysis of connected bodies .

Parallel coplanar forces – couple - resultant of parallel forces – centre of parallel forces – equilibrium of parallel forces – Simple beam subject to concentrated vertical loads. General coplanar force system - resultant and equilibrium equations.

### Module 3

Centroid of composite areas- – moment of inertia-parallel axis and perpendicular axis theorems. Polar moment of inertia, radius of gyration, mass moment of inertia-ring, cylinder and disc.

Theorem of Pappus Guldinus(demonstration only)

Forces in space - vectorial representation of forces, moments and couples –resultant and equilibrium equations – concurrent forces in space (simple problems only)

### Module 4

Dynamics – rectilinear translation - equations of kinematics(review)

kinetics – equation of motion – D'Alembert's principle. – motion on horizontal and inclined surfaces, motion of connected bodies. Impulse momentum equation and work energy equation (concepts only).

Curvilinear translation - equations of kinematics –projectile motion(review), kinetics – equation of motion. Moment of momentum and work energy equation (concepts only).

### Module 5

Rotation – kinematics of rotation- equation of motion for a rigid body rotating about a fixed axis – rotation under a constant moment.

Plane motion of rigid body – instantaneous centre of rotation (concept only).

Simple harmonic motion – free vibration –degree of freedom- undamped free vibration of spring mass system-effect of damping(concept only)

### Text Books

1. Timoshenko and Young, Engineering Mechanics, McGraw Hill Publishers
2. Shames, I. H., Engineering Mechanics - Statics and Dynamics, Prentice Hall of India.
3. R. C. Hibbeler and Ashok Gupta, Engineering Mechanics, Vol. I statics, Vol II Dynamics, Pearson Education.

## References

1. Merriam J. L and Kraige L. G., Engineering Mechanics - Vols. 1 and 2, John Wiley.
2. Tayal A K, Engineering Mechanics – Statics and Dynamics, Umesh Publications
3. Bhavikkatti, S.S., Engineering Mechanics, New Age International Publishers
4. F.P.Beer and E.R.Johnston (2011), Vector Mechanics for Engineers, Vol.I-Statics, Vol.II-Dynamics, 9<sup>th</sup> Ed, Tata McGraw Hill
5. Rajasekaran S and Sankarasubramanian G, Engineering Mechanics - Statics and Dynamics, Vikas Publishing House Pvt Ltd.

## Course Contents and Lecture Schedule:

Module	Topic	Course outcomes addressed	No. of Hours
<b>1</b>	<b>Module 1</b>		<b>Total: 7</b>
1.1	Introduction to engineering mechanics – introduction on statics and dynamics - Basic principles of statics – Parellogram law, equilibrium law – Superposition and transmissibility, law of action and reaction (review the topics)	CO1 and CO2	1
1.2	Free body diagrams. Degree of freedom-types of supports and nature of reactions - exercises for free body diagram preparation – composition and resolution of forces, resultant and equilibrium equations (review the topics) - numerical exercises for illustration.	CO1 and CO2	1
1.3	Concurrent coplanar forces - analysis of concurrent forces -methods of projections – illustrative numerical exercise – teacher assisted problem solving.	CO1 and CO2	1
1.4	Analysis of concurrent forces -methods of moment-Varignon’s Theorem of Moments - illustrative numerical exercise– teacher assisted problem solving.	CO1 and CO2	1
1.5	Analysis of concurrent force systems – extended problem solving - Session I.	CO3,CO4 and CO5	1
1.6	Analysis of concurrent force systems – extended problem solving - Session II – learning review quiz.	CO3,CO4 and CO5	1
1.7	Analysis of concurrent force systems – extended problem solving - Session III.	CO3,CO4 and CO5	1
<b>2</b>	<b>Module 2</b>		<b>Total: 7</b>
2.1	Friction – sliding friction - Coulomb’s laws of friction – analysis of single bodies –illustrative examples on wedges and ladder-teacher	CO1 and CO2	1

	assisted problem solving tutorials using problems from wedges and ladder.		
2.2	Problems on friction - analysis of connected bodies. illustrative numerical exercise– teacher assisted problem solving.	CO3, CO4 and CO5	1
2.3	Problems on friction-extended problem solving	CO3,CO4 and CO5	1
2.4	Parallel coplanar forces – couple - resultant of parallel forces – centre of parallel forces – equilibrium of parallel forces – Simple beam subject to concentrated vertical loads.	CO1 and CO2	1
2.5	General coplanar force system - resultant and equilibrium equations - illustrative examples- teacher assisted problem solving.	CO1 and CO2	1
2.6	General coplanar force system-resultant and equilibrium equations - illustrative examples	CO3, CO4 and CO5	1
2.7	General coplanar force system - Extended problem solving - Quiz to evaluate learning level.	CO3, CO4 and CO5	1
<b>3</b>	<b>Module 3</b>		<b>Total: 7</b>
3.1	Centroid of simple and regular geometrical shapes – centroid of figures in combination - composite areas- examples for illustration – problems for practice to be done by self.	CO1 and CO2	1
3.2	Moment of inertia- parallel axis theorem –examples for illustration - problems for practice to be done by self.	CO1 and CO2	1
3.3	Moment of inertia - perpendicular axis theorem - example for illustration to be given as hand out and discussion on the solved example.	CO1 and CO2	1
3.4	Solutions to practice problems – problems related to centroid and moment of inertia - problems for practice to be done by self.	CO3, CO4 and CO5	1
3.5	Polar moment of inertia, Radius of gyration. Mass moment of inertia of ring, cylinder and uniform disc. Theorem of Pappus Guldinus - Demonstration	CO1 and CO2	1
3.6	Introduction to forces in space – vectorial representation of forces, moments and couples – simple problems to illustrate vector representations of forces, moments and couples to be done in class.	CO1,and CO2	1
3.7	Solution to practice problems - resultant and equilibrium equations for concurrent forces in space – concurrent forces in space - 2 simple problems to illustrate the application of resultant and equilibrium equations for concurrent forces in space.	CO3,CO4 and CO5	1
<b>4</b>	<b>Module 4</b>		<b>Total: 7</b>

4.1	Introduction to dynamics – review of rectilinear translation - equations of kinematics – problems to review the concepts – additional problems involving extended application as exercises .	CO1 and CO2	1
4.2	Solutions to exercises with necessary explanation given as hand out – introduction to kinetics – equation of motion – D’Alembert’s principle – illustration of the concepts using one numerical exercise from motion on horizontal and inclined surfaces.	CO1 and CO2	1
4.3	Motion of connected bodies - example for illustration to be given as hand out and discussion on the solved example – problems for practice to be done by self.	CO3, CO4 and CO5	1
4.4	Motion of connected bodies-extended problem solving.	CO3, CO4 & CO5	1
4.5	Curvilinear translation - Review of kinematics –projectile motion – simple problems to review the concepts – introduction to kinetics – equation of motion – illustration of the concepts using numerical exercises.	CO3, CO4 & CO5	1
4.6	Extended problem solving – rectilinear and curvilinear translation.	CO3, CO4 & CO5	1
4.7	Concepts on Impulse momentum equation and work energy equation (rectilinear translation – discussions to bring out difference between elastic and inelastic collisions). Concepts on Moment of momentum and work energy equation (curvilinear translation).	CO1 and CO2	1
<b>5</b>	<b>Module 5</b>		<b>Total: 7</b>
5.1	Rotation – kinematics of rotation- equation of motion for a rigid body rotating about a fixed axis – simple problems for illustration.	CO1 and CO2	1
5.2	Rotation under a constant moment – teacher assisted problem solving.	CO3,CO4 and CO5	1
5.3	Rotation under a constant moment - extended problem solving.	CO3, CO4 and CO5	1
5.4	Plane motion of rigid body- instantaneous centre of rotation (concept only).	CO1 and CO2	1
5.5	Introduction to harmonic oscillation –free vibrations - simple harmonic motion – differential equation and solution.  Degree of freedom – examples of single degree of freedom (SDOF) systems – Idealisation of mechanical systems as spring-mass systems (concept only).	CO1 and CO2	1

5.6	<p>SDOF spring mass system –equation of motion – undamped free vibration response - concept of natural frequency.</p> <p>Free vibration response due to initial conditions.</p> <p>Simple problems on determination of natural frequency and free vibration response to test the understanding level.</p>	CO1 and CO2	1
5.7	<p>Free vibration analysis of SDOF spring-mass systems – Problem solving</p> <p>Effect of damping on free vibration response (concept only).</p>	CO1and CO2	1

AMERICAN KARAM  
TECHNOLOGICAL  
UNIVERSITY



CYT 100	ENGINEERING CHEMISTRY	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		BSC	3	1	0	4	2019

**Preamble:** To enable the students to acquire knowledge in the concepts of chemistry for engineering applications and to familiarize the students with different application oriented topics like spectroscopy, electrochemistry, instrumental methods etc. Also familiarize the students with topics like mechanism of corrosion, corrosion prevention methods, SEM, stereochemistry, polymers, desalination etc., which enable them to develop abilities and skills that are relevant to the study and practice of chemistry.

**Prerequisite:** Concepts of chemistry introduced at the plus two levels in schools

**Course outcomes:** After the completion of the course the students will be able to

CO 1	Apply the basic concepts of electrochemistry and corrosion to explore its possible applications in various engineering fields.
CO 2	Understand various spectroscopic techniques like UV-Visible, IR, NMR and its applications.
CO 3	Apply the knowledge of analytical method for characterizing a chemical mixture or a compound. Understand the basic concept of SEM for surface characterisation of nanomaterials.
CO 4	Learn about the basics of stereochemistry and its application. Apply the knowledge of conducting polymers and advanced polymers in engineering.
CO 5	Study various types of water treatment methods to develop skills for treating wastewater.

#### Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1	2	1									
CO 2	1	1		1	2							
CO 3	1	1		1	2							
CO 4	2	1										
CO 5	1			1			3					



## Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	15	15	30
Understand	25	25	50
Apply	10	10	20
Analyse			
Evaluate			
Create			

**End Semester Examination Pattern:** There will be two parts- **Part A** and **Part B**. **Part A** contains **10** questions (**2** questions from each module), having **3** marks for each question. Students should answer **all** questions. **Part B** contains **2** questions from each module, of which student should answer any one. Each question can have maximum **2** subdivisions and carries **14** marks.

### Course Level Assessment Questions

#### Course Outcome 1 (CO 1):

1. What is calomel electrode? Give the reduction reaction (3 Marks)
2. List three important advantages of potentiometric titration (3 Marks)
3. (a) Explain how electroless plating copper and nickel are carried out (10 Marks)  
(b) Calculate the emf of the following cell at 30°C,  $Zn / Zn^{2+} (0.1M) // Ag^+ (0.01M) // Ag$ .  
Given  $E^0 Zn^{2+}/Zn = -0.76 V$ ,  $E^0 Ag^+/Ag = 0.8 V$ . (4 Marks)

#### Course Outcome 2 (CO 2)

1. State Beer Lambert's law (3 Marks)
2. List the important applications of IR spectroscopy (3 Marks)
3. (a) What is Chemical shift? What are factors affecting Chemical shift? How  $^1H$  NMR spectrum of  $CH_3COCH_2Cl$  interpreted using the concept of chemical shift. (10 Marks)  
(b) Calculate the force constant of HF molecule, if it shows IR absorption at  $4138\text{ cm}^{-1}$ . Given that atomic masses of hydrogen and fluorine are 1u and 19u respectively. (4 Marks)

#### Course Outcome 3 (CO 3):

1. Distinguish between TGA and DTA (3 Marks)
2. Give two differences between GSC and GLC (3 Marks)

3. (a) Explain the principle, instrumentation and procedure of HPLC (10 Marks)

(b) Interpret TGA of  $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$  (4 Marks)

**Course Outcome 4 (CO 4):**

1. Explain the geometrical isomerism in double bonds (3 Marks)

2. What are the rules of assigning R-S notation? (3 Marks)

3. (a) What are conducting polymers? How it is classified? Give the preparation of polyaniline (10 Marks)

(b) Draw the stereoisomers possible for  $\text{CH}_3\text{-(CHOH)}_2\text{-COOH}$  (4 Marks)

**Course Outcome 5 (CO 5):**

1. What is degree of hardness? (3 Marks)

2. Define BOD and COD (3 Marks)

3. (a) Explain the EDTA estimation of hardness (10 Marks)

(b) Standard hard water contains 20 g of  $\text{CaCO}_3$  per liter, 50 mL of this required 30 mL of EDTA solution, 50 mL of sample water required 20 mL of EDTA solution. 50 mL sample water after boiling required 14 mL EDTA solution. Calculate the temporary hardness of the given sample of water, in terms of ppm. (4 Marks)

**MODEL QUESTION PAPER**

**Total Pages:**

Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
FIRST SEMESTER B.TECH DEGREE EXAMINATION

**Course Code: CYT100,**

**Course Name: ENGINEERING CHEMISTRY**

Max. Marks: 100

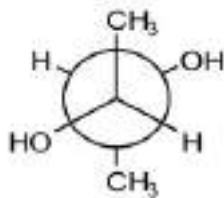
Duration: 3 Hours

**PART A**

**Answer all questions, each carries 3 marks**

- |   |  | Marks |
|---|--|-------|
| 1 | What is potentiometric titration? How the end point is determined graphically?   | (3)   |
| 2 | What is Galvanic series? How is it different from electrochemical series?  | (3)   |
| 3 | Which of the following molecules can give IR absorption? Give reason?<br>(a) $\text{O}_2$ (b) $\text{H}_2\text{O}$ (c) $\text{N}_2$ (d) $\text{HCl}$ | (3)   |
| 4 | Which of the following molecules show UV-Visible absorption? Give reason.<br>(a) Ethane      (b) Butadiene      (c) Benzene                          | (3)   |

- 5 What are the visualization techniques used in TLC? (3)
- 6 Write the three important applications of nanomaterials. (3)
- 7 Draw the Fischer projection formula and find R-S notation of (3)



- 8 Write the structure of a) Polypyrrole b) Kevlar. (3)
- 9 What is break point chlorination? (3)
- 10 What is reverse osmosis? (3)

### PART B

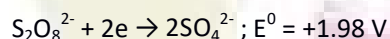
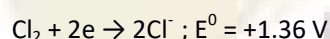
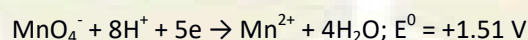
**Answer any one full question from each module, each question carries 14 marks**

#### Module 1

- 11 a) Give the construction of Li-ion cell. Give the reactions that take place at the electrodes during charging and discharging. What happens to anodic material when the cell is 100% charged. (10)
- b) Calculate the standard electrode potential of Cu, if its electrode potential at 25 °C is 0.296 V and the concentration of  $\text{Cu}^{2+}$  is 0.015 M. (4)

OR

- 12 a) Explain the mechanism of electrochemical corrosion of iron in oxygen rich and oxygen deficient acidic and basic environments. (10)
- b) Given below are reduction potentials of some species (4)



Use the above data to examine whether the acids, dil. HCl and dil.  $\text{H}_2\text{SO}_4$ , can be used to provide acid medium in redox titrations involving  $\text{KMnO}_4$ .

#### Module 2

- 13 a) What is spin-spin splitting? Draw the NMR spectrum of (i)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{Br}$  (ii)  $\text{CH}_3\text{CH}(\text{Br})\text{CH}_3$ . Explain how NMR spectrum can be used to identify the two isomers. (10)
- b) A dye solution of concentration 0.08M shows absorbance of 0.012 at 600 nm; while a test solution of same dye shows absorbance of 0.084 under same conditions. Find the concentration of the test solution. (4)

OR

- 14 a) Explain the basic principle of UV-Visible spectroscopy. What are the possible electronic transitions? Explain with examples. (10)
- b) Sketch the vibrational modes of  $\text{CO}_2$  and  $\text{H}_2\text{O}$ . Which of them are IR active? (4)

### Module 3

- 15 a) Explain the principle, instrumentation and procedure involved in gas chromatography. (10)  
b) Explain the DTA of  $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$  with a neat sketch. (4)

OR

- 16 a) Explain the various chemical methods used for the synthesis of nanomaterial (10)  
b) How TGA is used to analyse the thermal stability of polymers? (4)

### Module 4

- 17 a) What are conformers? Draw the *cis* and *trans* isomers of 1, 3-dimethylcyclohexane. (10)  
Which conformer (chair form) is more stable in each case?  
b) What is ABS? Give properties and applications. (4)

OR

- 18 a) Explain the various structural isomers with suitable example. (10)  
b) What is OLED? Draw a labelled diagram. (4)

### Module 5

- 19 a) What are ion exchange resins? Explain ion exchange process for removal of hardness of water? How exhausted resins are regenerated? (10)  
b) 50 mL sewage water is diluted to 2000 mL with dilution water; the initial dissolved oxygen was 7.7 ppm. The dissolved oxygen level after 5 days of incubation was 2.4 ppm. Find the BOD of the sewage. (4)

OR

- 20 a) What are the different steps in sewage treatment? Give the flow diagram. Explain the working of trickling filter. (10)  
b) Calculate the temporary and permanent hardness of a water sample which contains (4)  
 $[\text{Ca}^{2+}] = 160 \text{ mg/L}$ ,  $[\text{Mg}^{2+}] = 192 \text{ mg/L}$  and  $[\text{HCO}_3^-] = 122 \text{ mg/L}$ .

## Syllabus

### Module 1

#### Electrochemistry and Corrosion

Introduction - Differences between electrolytic and electrochemical cells - Daniel cell - redox reactions - cell representation. Different types of electrodes (brief) - Reference electrodes - SHE - Calomel electrode - Glass Electrode - Construction and Working. Single electrode potential - definition - Helmholtz electrical double layer -Determination of  $E^0$  using calomel electrode.Determination of pH using glass electrode.Electrochemical series and its applications. Free energy and EMF - Nernst Equation - Derivation - single electrode and cell (Numericals) -Application - Variation of emf with temperature. Potentiometric titration - Introduction -Redox titration only.Lithiumion cell - construction and working.Conductivity- Measurement of conductivity of a solution (Numericals).

Corrosion-Electrochemicalcorrosion – mechanism. Galvanic series- cathodic protection - electroless plating –Copper and Nickel plating.

## **Module 2**

### **Spectroscopic Techniques and Applications**

Introduction- Types of spectrum - electromagnetic spectrum - molecular energy levels - Beer Lambert's law (Numericals). UV-Visible Spectroscopy – Principle - Types of electronic transitions - Energy level diagram of ethane, butadiene, benzene and hexatriene. Instrumentation of UV-Visible spectrometer and applications. IR-Spectroscopy – Principle - Number of vibrational modes - Vibrational energy states of a diatomic molecule and -Determination of force constant of diatomic molecule (Numericals) –Applications.  $^1\text{H}$  NMR spectroscopy – Principle - Relation between field strength and frequency - chemical shift - spin-spin splitting (spectral problems ) - coupling constant (definition) - applications of NMR- including MRI (brief).

## **Module 3**

### **Instrumental Methods and Nanomaterials**

Thermal analysis –TGA- Principle, instrumentation (block diagram) and applications – TGA of  $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$  and polymers. DTA-Principle, instrumentation (block diagram) and applications - DTA of  $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$ . Chromatographic methods - Basic principles and applications of column and TLC- Retention factor. GC and HPLC-Principle, instrumentation (block diagram) - retention time and applications.

Nanomaterials - Definition - Classification - Chemical methods of preparation - Hydrolysis and Reduction - Applications of nanomaterials - Surface characterisation -SEM – Principle and instrumentation (block diagram).

## **Module 4**

### **Stereochemistry and Polymer Chemistry**

Isomerism-Structural, chain, position, functional, tautomerism and matamerism - Definition with examples - Representation of 3D structures-Newman, Sawhorse, Wedge and Fischer projection of substituted methane and ethane. Stereoisomerism - Geometrical isomerism in double bonds and cycloalkanes (cis-trans and E-Z notations). R-S Notation – Rules and examples - Optical isomerism, Chirality, Enantiomers and Diastereoisomers-Definition with examples. Conformational analysis of ethane, butane, cyclohexane, mono and di methyl substituted cyclohexane.

Copolymers - Definition - Types - Random, Alternating, Block and Graft copolymers - ABS - preparation, properties and applications. Kevlar-preparation, properties and applications. Conducting polymers - Doping -Polyaniline and Polypyrrole - preparation properties and applications. OLED - Principle, construction and advantages.

## **Module 5**

### **Water Chemistry and Sewage Water Treatment**

Water characteristics - Hardness - Types of hardness- Temporary and Permanent - Disadvantages of hard water -Units of hardness- ppm and mg/L -Degree of hardness (Numericals) - Estimation of

hardness-EDTA method (Numericals). Water softening methods-Ion exchange process-Principle, procedure and advantages. Reverse osmosis – principle, process and advantages. Municipal water treatment (brief) - Disinfection methods - chlorination, ozone and UV irradiation.

Dissolved oxygen (DO) -Estimation (only brief procedure-Winkler's method), BOD and COD-definition, estimation (only brief procedure) and significance (Numericals). Sewage water treatment - Primary, Secondary and Tertiary - Flow diagram -Trickling filter and UASB process.

#### **Text Books**

1. B. L. Tembe, Kamaluddin, M. S. Krishnan, "Engineering Chemistry (NPTEL Web-book)", 2018.
2. P. W. Atkins, "Physical Chemistry", Oxford University Press, 10<sup>th</sup> edn., 2014.

#### **Reference Books**

1. C. N. Banwell, "Fundamentals of Molecular Spectroscopy", McGraw-Hill, 4<sup>th</sup> edn., 1995.
2. Donald L. Pavia, "Introduction to Spectroscopy", Cengage Learning India Pvt. Ltd., 2015.
3. B. R. Puri, L. R. Sharma, M. S. Pathania, "Principles of Physical Chemistry", Vishal Publishing Co., 47<sup>th</sup> Edition, 2017.
4. H. H. Willard, L. L. Merritt, "Instrumental Methods of Analysis", CBS Publishers, 7<sup>th</sup> Edition, 2005.
5. Ernest L. Eliel, Samuel H. Wilen, "Stereo-chemistry of Organic Compounds", WILEY, 2008.
6. Raymond B. Seymour, Charles E. Carraher, "Polymer Chemistry: An Introduction", Marcel Dekker Inc; 4th Revised Edition, 1996.
7. Muhammed Arif, Annette Fernandez, Kavitha P. Nair "Engineering Chemistry", Owl Books, 2019.
8. Ahad J., "Engineering Chemistry", Jai Publication, 2019.
9. Roy K. Varghese, "Engineering Chemistry", Crownplus Publishers, 2019.
10. Soney C. George, Rino Laly Jose, "Text Book of Engineering Chemistry", S. Chand & Company Pvt Ltd, 2019.

## Course Contents and Lecture Schedule

No	Topic	No. of Lectures (hrs)
<b>1</b>	<b>Electrochemistry and Corrosion</b>	<b>9</b>
<b>1.1</b>	Introduction - Differences between electrolytic and electrochemical cells- Daniel cell - redox reactions - cell representation. Different types of electrodes (brief) - Reference electrodes- SHE - Calomel electrode - Glass Electrode - Construction and Working.	<b>2</b>
<b>1.2</b>	Single electrode potential – definition - Helmholtz electrical double layer - Determination of $E^0$ using calomel electrode. Determination of pH using glass electrode. Electrochemical series and its applications. Free energy and EMF - Nernst Equation – Derivation - single electrode and cell (Numericals) -Application -Variation of emf with temperature.	<b>3</b>
<b>1.3</b>	Potentiometric titration - Introduction -Redox titration only. Lithiumion cell - construction and working. Conductivity- Measurement of conductivity of a solution (Numericals).	<b>2</b>
<b>1.4</b>	Corrosion-Electrochemicalcorrosion – mechanism. Galvanic series- cathodic protection - electroless plating –Copper and Nickel plating.	<b>2</b>
<b>2</b>	<b>Spectroscopic Techniques and Applications</b>	<b>9</b>
<b>2.1</b>	Introduction- Types of spectrum - electromagnetic spectrum - molecular energy levels - Beer Lambert’s law (Numericals).	<b>2</b>
<b>2.2</b>	UV-Visible Spectroscopy – Principle - Types of electronic transitions - Energy level diagram of ethane, butadiene, benzene and hexatriene. Instrumentation of UV-Visible spectrometer and applications.	<b>2</b>
<b>2.3</b>	IR-Spectroscopy – Principle - Number of vibrational modes -Vibrational energy states of a diatomic molecule and -Determination of force constant of diatomic molecule (Numericals) –Applications.	<b>2</b>
<b>2.4</b>	$^1\text{H}$ NMR spectroscopy – Principle - Relation between field strength and frequency - chemical shift - spin-spin splitting (spectral problems ) - coupling constant (definition) - applications of NMR- including MRI (brief).	<b>3</b>
<b>3</b>	<b>Instrumental Methods and Nanomaterials</b>	<b>9</b>
<b>3.1</b>	Thermal analysis –TGA- Principle, instrumentation (block diagram) and applications – TGA of $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$ and polymers. DTA-Principle, instrumentation (block diagram) and applications - DTA of $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$ .	<b>2</b>

3.2	Chromatographic methods - Basic principles and applications of column and TLC-Retention factor.	2
3.3	GC and HPLC-Principle, instrumentation (block diagram) - retention time and applications.	2
3.4	Nanomaterials - Definition - Classification - Chemical methods of preparation - Hydrolysis and Reduction - Applications of nanomaterials - Surface characterisation -SEM – Principle and instrumentation (block diagram).	3
4	<b>Stereochemistry and Polymer Chemistry</b>	9
4.1	Isomerism-Structural, chain, position, functional, tautomerism and matamerism - Definition with examples - Representation of 3D structures-Newman, Sawhorse, Wedge and Fischer projection of substituted methane and ethane. Stereoisomerism - Geometrical isomerism in double bonds and cycloalkanes (cis-trans and E-Z notations).	2
4.2	R-S Notation – Rules and examples - Optical isomerism, Chirality, Enantiomers and Diastereoisomers-Definition with examples.	1
4.3	Conformational analysis of ethane, butane, cyclohexane, mono and di methyl substituted cyclohexane.	2
4.4	Copolymers - Definition - Types - Random, Alternating, Block and Graft copolymers - ABS - preparation, properties and applications. Kevlar-preparation, properties and applications. Conducting polymers - Doping -Polyaniline and Polypyrrole - preparation properties and applications. OLED - Principle, construction and advantages.	4
5	<b>Water Chemistry and Sewage Water Treatment</b>	9
5.1	Water characteristics - Hardness - Types of hardness- Temporary and Permanent - Disadvantages of hard water -Units of hardness- ppm and mg/L -Degree of hardness (Numericals) - Estimation of hardness-EDTA method (Numericals). Water softening methods-Ion exchange process-Principle, procedure and advantages. Reverse osmosis – principle, process and advantages.	3
5.2	Municipal water treatment (brief) - Disinfection methods - chlorination, ozone and UV irradiation.	2
5.3	Dissolved oxygen (DO) -Estimation (only brief procedure-Winkler's method), BOD and COD-definition, estimation (only brief procedure) and significance (Numericals).	2
5.4	Sewage water treatment - Primary, Secondary and Tertiary - Flow diagram - Trickling filter and UASB process.	2



CYL 120	ENGINEERING CHEMISTRY LAB	CATEGORY	L	T	P	CREDIT
		BSC	0	0	2	1

**Preamble:** To impart scientific approach and to familiarize with the experiments in chemistry relevant for research projects in higher semesters

**Prerequisite:** Experiments in chemistry introduced at the plus two levels in schools

**Course outcomes:** After the completion of the course the students will be able to

<b>CO 1</b>	Understand and practice different techniques of quantitative chemical analysis to generate experimental skills and apply these skills to various analyses
<b>CO 2</b>	Develop skills relevant to synthesize organic polymers and acquire the practical skill to use TLC for the identification of drugs
<b>CO 3</b>	Develop the ability to understand and explain the use of modern spectroscopic techniques for analysing and interpreting the IR spectra and NMR spectra of some organic compounds
<b>CO 4</b>	Acquire the ability to understand, explain and use instrumental techniques for chemical analysis
<b>CO 5</b>	Learn to design and carry out scientific experiments as well as accurately record and analyze the results of such experiments
<b>CO 6</b>	Function as a member of a team, communicate effectively and engage in further learning. Also understand how chemistry addresses social, economical and environmental problems and why it is an integral part of curriculum

**Mapping of course outcomes with program outcomes**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
<b>CO 1</b>	3				2							3
<b>CO 2</b>	3				3							3
<b>CO 3</b>	3				3							3
<b>CO 4</b>	3				3							3
<b>CO 5</b>	3				1							3
<b>CO 6</b>	3				1							3

**Mark distribution**

Total Marks	CIE marks	ESE marks	ESE Duration(Internal)
100	100	-	1 hour

**Continuous Internal Evaluation Pattern:**

Attendance	: 20 marks
Class work/ Assessment/Viva-voce	: 50 marks
End semester examination (Internally by college)	: 30 marks

**End Semester Examination Pattern:** Written Objective Examination of one hour

**SYLLABUS****LIST OF EXPERIMENTS (MINIMUM 8 MANDATORY)**

1. Estimation of total hardness of water-EDTA method
2. Potentiometric titration
3. Determination of cell constant and conductance of solutions.
4. Calibration of pH meter and determination of pH of a solution
5. Estimation of chloride in water
6. Identification of drugs using TLC
7. Determination of wavelength of absorption maximum and colorimetric estimation of  $\text{Fe}^{3+}$  in solution
8. Determination of molar absorptivity of a compound ( $\text{KMnO}_4$  or any water soluble food colorant)
9. Synthesis of polymers (a) Urea-formaldehyde resin (b) Phenol-formaldehyde resin
10. Estimation of iron in iron ore
11. Estimation of copper in brass
12. Estimation of dissolved oxygen by Winkler's method
13. (a) Analysis of IR spectra (minimum 3 spectra) (b) Analysis of  $^1\text{H}$  NMR spectra (minimum 3 spectra)
14. Flame photometric estimation of  $\text{Na}^+$  to find out the salinity in sand
15. Determination of acid value of a vegetable oil
16. Determination of saponification of a vegetable oil

**Reference Books**

1. G. Svehla, B. Sivasankar, "Vogel's Qualitative Inorganic Analysis", Pearson, 2012.
2. R. K. Mohapatra, "Engineering Chemistry with Laboratory Experiments", PHI Learning, 2017.
3. Muhammed Arif, "Engineering Chemistry Lab Manual", Owl publishers, 2019.
4. Ahad J., "Engineering Chemistry Lab manual", Jai Publications, 2019.
5. Roy K Varghese, "Engineering Chemistry Laboratory Manual", Crownplus Publishers, 2019.
6. Soney C George, Rino Laly Jose, "Lab Manual of Engineering Chemistry", S. Chand & Company Pvt Ltd, New Delhi, 2019.

PHT 100	ENGINEERING PHYSICS A (FOR CIRCUIT BRANCHES)	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		BSC	3	1	0	4	2019

**Preamble:** The aim of the Engineering Physics Program is to offer students a solid background in the fundamentals of Physics and to impart that knowledge in engineering disciplines. The program is designed to develop scientific attitudes and enable the students to correlate the concepts of Physics with the core programmes

**Prerequisite:** Higher secondary level Physics, Mathematical course on vector calculus, differential equations and linear algebra

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

CO 1	Compute the quantitative aspects of waves and oscillations in engineering systems.
CO 2	Apply the interaction of light with matter through interference, diffraction and identify these phenomena in different natural optical processes and optical instruments.
CO 3	Analyze the behaviour of matter in the atomic and subatomic level through the principles of quantum mechanics to perceive the microscopic processes in electronic devices.
CO 4	Classify the properties of magnetic materials and apply vector calculus to static magnetic fields and use Maxwell's equations to diverse engineering problems
CO 5	Analyze the principles behind various superconducting applications, explain the working of solid state lighting devices and fibre optic communication system

**Mapping of course outcomes with program outcomes**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2						1	2			1
CO 2	3	2						1	2			1
CO 3	3	2						1	2			1
CO 4	3	1						1	2			1
CO 5	3	1						1	2			1

**Assessment Pattern**

Bloom's Category	Continuous Assessment Tests		End Semester Examination (Marks)
	Test 1 (Marks)	Test 2 (Marks)	
Remember	15	15	30
Understand	25	25	50
Apply	10	10	20

Analyse			
Evaluate			
Create			

### Mark distribution

Total Marks	CIE marks	ESE marks	ESE Duration
150	50	100	3 hours

### Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

**End Semester Examination Pattern:** There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

### Course Level Assessment Questions

#### Course Outcome 1 (CO1):

1. Explain the effect of damping force on oscillators.
2. Distinguish between transverse and longitudinal waves.
3. (a) Derive an expression for the fundamental frequency of transverse vibration in a stretched string.  
(b) Calculate the fundamental frequency of a string of length 2 m weighing 6 g kept stretched by a load of 600 kg.

#### Course Outcome 2 (CO2):

1. Explain colours in thin films.
2. Distinguish between Fresnel and Fraunhofer diffraction.
3. (a) Explain the formation of Newton's rings and obtain the expression for radii of bright and dark rings in reflected system. Also explain how it is used to determine the wavelength of a monochromatic source of light.  
(b) A liquid of refractive index  $\mu$  is introduced between the lens and glass plate.

What happens to the fringe system? Justify your answer.

**Course Outcome 3 (CO3):**

1. Give the physical significance of wave function ?
2. What are excitons ?
3. (a) Solve Schrodinger equation for a particle in a one dimensional box and obtain its energy eigen values and normalised wave functions.  
(b) Calculate the first three energy values of an electron in a one dimensional box of width  $1 \text{ \AA}$  in electron volt.

**Course Outcome 4 (CO4):**

1. Compare displacement current and conduction current.
2. Mention any four properties of ferro magnetic materials.
3. (a) Starting from Maxwell's equations, derive the free space electromagnetic wave equation and show that velocity of electromagnetic wave is  $1/(\mu_0 \epsilon_0)^{1/2}$   
(b) An electromagnetic wave is described by  $E = 100 \exp 8\pi i [10^{14} t - (10^6 z / 3)] \text{ V/m}$ . Find the direction of propagation of the wave, speed of the wave and magnetic flux density in the wave.

**Course Outcome 5 (CO5):**

1. Explain the working of a solar cell.
2. Distinguish between Type I and Type II super conductors.
3. (a) Define numerical aperture and derive an expression for it.  
(b) Explain the working of intensity modulated fibre optic sensor.

**Model Question paper**

**QP CODE:**

**PAGES:3**

Reg No: \_\_\_\_\_

Name : \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION,  
MONTH & YEAR**

**Course Code: PHT 100**

**Course Name: Engineering Physics A**

**Max. Marks: 100**

**Duration: 3 Hours**

**PART A**

**Answer all Questions. Each question carries 3 Marks**

1. Compare electrical and mechanical oscillators
2. Distinguish between longitudinal and transverse waves
3. Write a short note on antireflection coating.
4. Diffraction of light is not as evident in daily experience as that of sound waves. Give reason.
5. State and explain Heisenberg's Uncertainty principle. With the help of it explain natural line broadening.
6. Explain surface to volume ratio of nanomaterials.
7. State Faraday's laws of electromagnetic induction.
8. Compare displacement current and conduction current
9. List four important applications of superconductors.
10. Give the working principle of LED. (10x3=30)

**PART B**

**Answer any one full question from each module. Each question carries 14 Marks**

**Module 1**

11. (a) Derive the differential equation of damped harmonic oscillator and deduce its solution. Discuss the cases of over damped, critically damped and under damped cases. (10)
- (b) The frequency of a tuning fork is 500 Hz and its Q factor is  $7 \times 10^4$ . Find the relaxation time. Also calculate the time after which its energy becomes 1/10 of its initial undamped value. (4)
12. (a) Derive an expression for the velocity of propagation of a transverse wave in a stretched string. Deduce laws of transverse vibrations. (10)
- (b) The equation of transverse vibration of a stretched string is given by  $y = 0.00327 \sin(72.1x - 2.72t)$  m, in which the numerical constants are in S.I units. Evaluate (i) Amplitude (ii) Wavelength (iii) Frequency and (iv) Velocity of the wave. (4)

### Module 2

13. (a) Explain the formation of Newton's rings and show that the radius of dark ring is proportional to the square root of natural numbers. How can we use Newton's rings experiment to determine the refractive index of a liquid. (10)
- (b) Two pieces of plane glass are placed together with a piece of paper between two at one end. Find the angle of the wedge in seconds if the film is viewed with a monochromatic light of wavelength  $4800 \text{ \AA}$ . Given  $\beta = 0.0555 \text{ cm}$ . (4)
14. (a) Explain the diffraction due to a plane transmission grating. Obtain the grating equation. (10)
- (b) A grating has 6000 lines per cm. Find the angular separation of the two yellow lines of mercury of wavelengths 577 nm and 579 nm in the second order. (4)

### Module 3

15. (a) Derive time dependent and independent Schrodinger equations. (10)
- (b) An electron is confined to one dimensional potential box of length  $2 \text{ \AA}$ . Calculate the energies corresponding to the first and second quantum states in eV. (4)
16. (a) Classify nanomaterials based on dimensionality of quantum confinement and explain the following nanostructures. (i) nano sheets (ii) nano wires (iii) quantum dots. (10)
- (b) Find the de Broglie wavelength of electron whose kinetic energy is 15 eV. (4)

### Module 4

17. (a) State Poynting's Theorem. Calculate the value of Poynting vector at the surface of the sun if the power radiated by the sun is  $3.8 \times 10^{26} \text{ W}$  and its radius is  $7 \times 10^8 \text{ m}$ . (5)

(b) Distinguish between paramagnetic, diamagnetic and ferromagnetic materials. (9)

18.(a) Starting from Maxwell's Equations, derive electromagnetic wave equations in free space. (10)

(b) If the magnitude of  $\mathbf{H}$  in a plane wave is 1 A/m, find the magnitude of  $\mathbf{E}$  in free space. (4)

### Module 5

19.(a) Show that superconductors are perfect diamagnets. Distinguish between Type I and Type II superconductors with suitable examples. (10)

(b) Write a short note on high temperature superconductors. (4)

20.(a) Define numerical aperture of an optic fibre and derive an expression for the NA of a step index fibre with a neat diagram. (10)

(b) Calculate the numerical aperture and acceptance angle of a fibre with a core refractive index of 1.54 and a cladding refractive index of 1.50 when the fibre is inside water of refractive index 1.33. (4) (14x5=70)



## Syllabus

### ENGINEERING PHYSICS A (FOR CIRCUIT BRANCHES)

#### Module 1

##### Oscillations and Waves

Harmonic oscillations, Damped harmonic motion-Derivation of differential equation and its solution, Over damped, Critically damped and Under damped Cases, Quality factor-Expression, Forced oscillations-Differential Equation-Derivation of expressions for amplitude and phase of forced oscillations, Amplitude Resonance-Expression for Resonant frequency, Quality factor and Sharpness of Resonance, Electrical analogy of mechanical oscillators

Wave motion- Derivation of one dimensional wave equation and its solution, Three dimensional wave equation and its solution (no derivation), Distinction between transverse and longitudinal waves, Transverse vibration in a stretched string, Statement of laws of vibration

#### Module 2

##### Wave Optics

Interference of light-Principle of superposition of waves, Theory of thin films - Cosine law (Reflected system), Derivation of the conditions of constructive and destructive Interference, Interference due to wedge shaped films -Determination of thickness and test for optical planeness, Newton's rings - Measurement of wavelength and refractive index, Antireflection coatings

Diffraction of light, Fresnel and Fraunhofer classes of diffraction, Diffraction grating-Grating equation, Rayleigh criterion for limit of resolution, Resolving and Dispersive power of a grating with expression (no derivation)

#### Module 3

##### Quantum Mechanics & Nanotechnology

Introduction for the need of Quantum mechanics, Wave nature of Particles, Uncertainty principle, Applications-Absence of electrons inside a nucleus and Natural line broadening mechanism, Formulation of time dependent and independent Schrodinger wave equations-Physical meaning of wave function, Particle in a one dimensional box- Derivation for normalised wave function and energy eigen values, Quantum Mechanical Tunnelling (Qualitative)

Introduction to nanoscience and technology, Increase in surface to volume ratio for nanomaterials, Quantum confinement in one dimension, two dimension and three dimension-Nano sheets, Nano wires and Quantum dots, Properties of nanomaterials-mechanical, electrical and optical, Applications of nanotechnology (qualitative ideas)

#### Module 4

##### Magnetism & Electro Magnetic Theory

Magnetic field and Magnetic flux density, Gauss's law for Magnetic flux density, Ampere's Circuital law, Faraday's law in terms of EMF produced by changing magnetic flux, Magnetic permeability and susceptibility, Classification of magnetic materials-para, dia and ferromagnetic materials

Fundamentals of vector calculus, concept of divergence, gradient and curl along with physical significance, Line, Surface and Volume integrals, Gauss divergence theorem & Stokes' theorem, Equation of continuity, Derivation of Maxwell's equations in vacuum, Comparison of displacement current with conduction current. Electromagnetic waves, Velocity of Electromagnetic waves in free space, Flow of energy and Poynting's vector (no derivation)

## **Module 5**

### **Superconductivity & Photonics**

Superconducting phenomena, Meissner effect and perfect diamagnetism, Types of superconductors-Type I and Type II, BCS Theory (Qualitative), High temperature superconductors-Applications of super conductivity

Introduction to photonics-Photonic devices-Light Emitting Diode, Photo detectors -Junction and PIN photodiodes, Solar cells-I-V Characteristics, Optic fibre-Principle of propagation of light, Types of fibres-Step index and Graded index fibres, Numerical aperture –Derivation, Fibre optic communication system (block diagram), Industrial, Medical and Technological applications of optical fibre, Fibre optic sensors-Intensity Modulated and Phase modulated sensors.

### **Text Books**

1. M.N.Avadhanulu, P.G.Kshirsagar,TVS Arun Murthy "A Text book of Engineering Physics", S.Chand &Co., Revised Edition 2019
2. H.K.Malik , A.K. Singh, "Engineering Physics" McGraw Hill Education, Second Edition 2017

### **Reference Books**

1. Arthur Beiser, "Concepts of Modern Physics ", Tata McGraw Hill Publications, 6th Edition 2003
2. D.K. Bhattacharya, Poonam Tandon, "Engineering Physics", Oxford University Press, 2015
3. Md.N.Khan & S.Panigrahi "Principles of Engineering Physics 1&2", Cambridge University Press, 2016
4. Aruldhas G., "Engineering Physics", PHI Pvt. Ltd., 2015
5. Ajoy Ghatak, "Optics", Mc Graw Hill Education, Sixth Edition, 2017
6. T. Pradeep, "Nano:The Essentials", McGraw Hill India Ltd, 2007
7. Halliday, Resnick, Walker, "Fundamentals of Physics", John Wiley & Sons.Inc, 2001
8. David J Griffiths, "Introduction to Electrodynamics", Addison-Wesley publishing, 3rd Edition, 1999
9. Premlet B., "Advanced Engineering Physics", Phasor Books,10<sup>th</sup> edition,2017
10. I. Dominic and. A. Nahari, "A Text Book of Engineering physics", Owl Books Publishers, Revised edition, 2016

### Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	<b>Oscillations and Waves (9 hours)</b>	
1.1	Harmonic oscillations, Damped harmonic motion-Derivation of differential equation and its solution, Over damped, Critically damped and Under damped Cases, Quality factor-Expression	2 hrs
1.2	Forced oscillations-Differential Equation-Derivation of expressions for amplitude and phase of forced oscillations, Amplitude Resonance-Expression for Resonant frequency, Quality factor and Sharpness of Resonance, Electrical analogy of mechanical oscillators	3hrs
1.3	Wave motion- Derivation of one dimensional wave equation and its solution, Three dimensional wave equation and its solution (no derivation)	2 hrs
1.4	Distinction between transverse and longitudinal waves. Transverse vibration in a stretched string, Statement of laws of vibration	2 hrs
2	<b>Wave Optics (9 hours)</b>	
2.1	Interference of light-Principle of superposition of waves, Theory of thin films - Cosine law (Reflected system), Derivation of the conditions of constructive and destructive Interference	2 hrs
2.2	Interference due to wedge shaped films -Determination of thickness and test for optical planeness, Newton's rings - Measurement of wavelength and refractive index, Antireflection coatings	4 hr
2.3	Diffraction of light, Fresnel and Fraunhofer classes of diffraction, Diffraction grating-Grating equation	2 hrs
2.4	Rayleigh criterion for limit of resolution, Resolving and Dispersive power of a grating with expression (no derivation)	1 hr
3	<b>Quantum Mechanics &amp; Nanotechnology (9hours)</b>	
3.1	Introduction for the need of Quantum mechanics, Wave nature of Particles, Uncertainty principle, Applications-Absence of electrons inside a nucleus and Natural line broadening mechanism	2 hrs
3.2	Formulation of time dependent and independent Schrodinger wave equations-Physical Meaning of wave function, Particle in a one dimensional box- Derivation for normalised wave function and energy eigen values, Quantum Mechanical Tunnelling (Qualitative)	4 hrs
3.3	Introduction to nanoscience and technology, Increase in surface to volume ratio for nanomaterials, Quantum confinement in one dimension, two dimension and three dimension-Nano sheets, Nano wires and Quantum dots	2 hrs
3.4	Properties of nanomaterials-mechanical, electrical and optical Applications of nanotechnology (qualitative ideas)	1 hr
4	<b>Magnetism &amp; Electro Magnetic Theory (9 hours)</b>	
4.1	Magnetic field and Magnetic flux density, Gauss's law for Magnetic flux	2 hrs

	density, Ampere's Circuital law, Faraday's law in terms of EMF produced by changing magnetic flux	
4.2	Explanation for Magnetic permeability and susceptibility Classification of magnetic materials- para, dia and ferromagnetic materials	1 hr
4.3	Fundamentals of vector calculus, concept of divergence, gradient and curl along with physical significance, Line, Surface and Volume integrals, Gauss divergence theorem & Stokes' theorem	2 hrs
4.4	Equation of continuity, Derivation of Maxwell's equations in vacuum, Comparison of displacement current with conduction current. Electromagnetic waves, Velocity of Electromagnetic waves in free space, Flow of energy and Poynting's vector (no derivation)	4 hrs
5	<b>Superconductivity &amp; Photonics (9hours)</b>	
5.1	Super conducting Phenomena, Meissner effect and perfect diamagnetism, Types of superconductors-Type I and Type II	2 hrs
5.2	BCS Theory (Qualitative), High temperature superconductors, Applications of super conductivity	2 hrs
5.3	Introduction to photonics-Photonic devices-Light Emitting Diode, Photo detectors -Junction and PIN photodiodes, Solar cells-I-V Characteristics	2 hrs
5.4	Optic fibre-Principle of propagation of light, Types of fibres-Step index and Graded index fibres, Numerical aperture -Derivation, Fibre optic communication system (block diagram), Industrial, Medical and Technological applications of optical fibre, Fibre optic sensors-Intensity Modulated and Phase modulated sensors	3 hrs

PHT 110	ENGINEERING PHYSICS B (FOR NON-CIRCUIT BRANCHES)	Category	L	T	P	CREDIT	Year of Introduction
		BSC	3	1	0	4	2019

**Preamble:** The aim of the Engineering Physics program is to offer students a solid background in the fundamentals of Physics and to impart that knowledge in engineering disciplines. The program is designed to develop scientific attitudes and enable the students to correlate the concepts of Physics with the core programmes

**Prerequisite:** Higher secondary level Physics, Mathematical course on vector calculus, differential equations and linear algebra

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

CO 1	Compute the quantitative aspects of waves and oscillations in engineering systems.
CO 2	Apply the interaction of light with matter through interference, diffraction and identify these phenomena in different natural optical processes and optical instruments.
CO 3	Analyze the behaviour of matter in the atomic and subatomic level through the principles of quantum mechanics to perceive the microscopic processes in electronic devices.
CO 4	Apply the knowledge of ultrasonics in non-destructive testing and use the principles of acoustics to explain the nature and characterization of acoustic design and to provide a safe and healthy environment
CO 5	Apply the comprehended knowledge about laser and fibre optic communication systems in various engineering applications

**Mapping of course outcomes with program outcomes**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2						1	2			1
CO 2	3	2						1	2			1
CO 3	3	2						1	2			1
CO 4	3							1	2			1
CO 5	3	2						1	2			1

**Assessment Pattern**

Bloom's Category	Continuous Assessment Tests		End Semester Examination (Marks)
	Test 1 (Marks)	Test 2 (Marks)	
Remember	15	15	30
Understand	25	25	50

Apply	10	10	20
Analyse			
Evaluate			
Create			

### Mark distribution

Total Marks	CIE MARKS	ESE MARKS	ESE Duration
150	50	100	3 hours

### Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

**End Semester Examination Pattern:** There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

### Course Level Assessment Questions

#### Course Outcome 1 (CO1):

1. Explain the effect of damping force on oscillators.
2. Distinguish between transverse and longitudinal waves.
3. (a) Derive an expression for the fundamental frequency of transverse vibration in a stretched string.  
(b) Calculate the fundamental frequency of a string of length 2 m weighing 6 g kept stretched by a load of 600 kg.

#### Course Outcome 2 (CO2):

1. Explain colours in thin films.
2. Distinguish between Fresnel and Fraunhofer diffraction.
3. (a) Explain the formation of Newton's rings and obtain the expression for radii of bright and dark rings in reflected system. Also explain how it is used to determine the wavelength of a monochromatic source of light.  
(b) A liquid of refractive index  $\mu$  is introduced between the lens and glass plate. What happens to the fringe system? Justify your answer.

#### Course Outcome 3 (CO3):

1. Give the physical significance of wave function?

2. What are excitons ?
3. (a) Solve Schrodinger equation for a particle in a one dimensional box and obtain its energy eigen values and normalised wave functions.  
(b) Calculate the first three energy values of an electron in a one dimensional box of width  $1 \text{ \AA}$  in electron volt.

**Course Outcome 4 (CO4):**

1. Explain reverberation and reverberation time.
2. How ultrasonic waves are used in non-destructive testing.
3. (a) With a neat diagram explain how ultrasonic waves are produced by a piezoelectric oscillator.  
(b) Calculate frequency of ultrasonic waves that can be produced by a nickel rod of length 4 cm. (Young's Modulus = 207 G Pa, Density = 8900 Kg /m<sup>3</sup>)

**Course Outcome 5 (CO 5):**

1. Distinguish between spontaneous emission and stimulated emission.
2. Explain optical resonators.
3. (a) Explain the construction and working of Ruby Laser.  
(b) Calculate the numerical aperture and acceptance angle of a fibre with a core refractive index of 1.54 and a cladding refractive index of 1.50 when the fibre is inside water of refractive index 1.33.

**Model Question paper**

QP CODE:

PAGES:3

Reg No: \_\_\_\_\_

Name : \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION,  
MONTH & YEAR**

**Course Code: PHT 110**

**Course Name: Engineering Physics B**

**Max.Marks: 100**

**Duration: 3 Hours**

**PART A**

**Answer all Questions. Each question carries 3 Marks**

1. Compare electrical and mechanical oscillators.
2. Distinguish between longitudinal and transverse waves.
3. Write a short note on antireflection coating.
4. Diffraction of light is not as evident in daily experience as that of sound waves. Give reason.
5. State and explain Heisenberg's Uncertainty principle. With the help of it explain natural line broadening.
6. Explain surface to volume ratio of nanomaterials.
7. Define sound intensity level. Give the values of threshold of hearing and threshold of pain.
8. Describe the method of non-destructive testing using ultra sonic waves
9. Explain the condition of population inversion
10. Distinguish between step index and graded index fibre. (10x3=30)

**PART B**

**Answer any one full question from each module. Each question carries 14 Marks**

**Module 1**

11. (a) Derive the differential equation of damped harmonic oscillator and deduce its solution. Discuss the cases of over damped, critically damped and under damped cases. (10)



- (b) The frequency of a tuning fork is 500 Hz and its Q factor is  $7 \times 10^4$ . Find the relaxation time. Also calculate the time after which its energy becomes 1/10 of its initial undamped value. (4)
12. (a) Derive an expression for the velocity of propagation of a transverse wave in a stretched string. Deduce laws of transverse vibrations. (10)
- (b) The equation of transverse vibration of a stretched string is given by  $y = 0.00327 \sin(72.1x - 2.72t)$  m, in which the numerical constants are in S.I units. Evaluate (i) Amplitude (ii) Wavelength (iii) Frequency and (iv) Velocity of the wave. (4)

### Module 2

13. (a) Explain the formation of Newton's rings and show that the radius of dark ring is proportional to the square root of natural numbers. How can we use Newton's rings experiment to determine the refractive index of a liquid? (10)
- (b) Two pieces of plane glass are placed together with a piece of paper between two at one end. Find the angle of the wedge in seconds if the film is viewed with a monochromatic light of wavelength  $4800 \text{ \AA}$ . Given  $\beta = 0.0555 \text{ cm}$ . (4)
14. (a) Explain the diffraction due to a plane transmission grating. Obtain the grating equation. (10)
- (b) A grating has 6000 lines per cm. Find the angular separation of the two yellow lines of mercury of wavelengths 577 nm and 579 nm in the second order. (4)

### Module 3

15. (a) Derive time dependent and independent Schrodinger equations. (10)
- (b) An electron is confined to one dimensional potential box of length  $2 \text{ \AA}$ . Calculate the energies corresponding to the first and second quantum states in eV. (4)
16. (a) Classify nanomaterials based on dimensionality of quantum confinement and explain the following nanostructures. (i) nano sheets (ii) nano wires (iii) quantum dots. (10)
- (b) Find the de Broglie wavelength of electron whose kinetic energy is 15 eV. (4)

### Module 4

17. (a) Explain reverberation and reverberation time? What is the significance of Reverberation time. Explain the factors affecting the acoustics of a building and their corrective measures? (10)
- (b) The volume of a hall is  $3000 \text{ m}^3$ . It has a total absorption of  $100 \text{ m}^2$  sabine. If the hall is filled with audience who add another  $80 \text{ m}^2$  sabine, then find the difference in reverberation time. (4)
18. (a) With a neat diagram explain how ultrasonic waves are produced by piezoelectric oscillator. Also discuss the piezoelectric method of detection of ultrasonic waves. (10)

- (b) An ultrasonic source of 0.09 MHz sends down a pulse towards the sea bed which returns after 0.55 sec. The velocity of sound in sea water is 1800 m/s. Calculate the depth of the sea and the wavelength of the pulse. (4)

**Module 5**

19. (a) Outline the construction and working of Ruby laser. (8)

- (b) What is the principle of holography? How is a hologram recorded? (6)

20. (a) Define numerical aperture of an optic fibre and derive an expression for the NA of a step index fibre with a neat diagram. (10)

- (b) An optical fibre made with core of refractive index 1.5 and cladding with a fractional index difference of 0.0006. Find refractive index of cladding and numerical aperture. (4)

(14x5=70)



## SYLLABUS

### ENGINEERING PHYSICS B (FOR NON-CIRCUIT BRANCHES)

#### Module 1

##### Oscillations and Waves

Harmonic oscillations, Damped harmonic motion-Derivation of differential equation and its solution, Over damped, Critically damped and Under damped Cases, Quality factor-Expression, Forced oscillations-Differential Equation-Derivation of expressions for amplitude and phase of forced oscillations, Amplitude Resonance-Expression for Resonant frequency, Quality factor and Sharpness of Resonance, Electrical analogy of mechanical oscillators

Wave motion- Derivation of one dimensional wave equation and its solution, Three dimensional wave equation and its solution (no derivation), Distinction between transverse and longitudinal waves, Transverse vibration in a stretched string, Statement of laws of vibration

#### Module 2

##### Wave Optics

Interference of light-Principle of superposition of waves, Theory of thin films - Cosine law (Reflected system), Derivation of the conditions of constructive and destructive Interference, Interference due to wedge shaped films -Determination of thickness and test for optical planeness, Newton's rings - Measurement of wavelength and refractive index, Antireflection coatings

Diffraction of light, Fresnel and Fraunhofer classes of diffraction, Diffraction grating-Grating equation, Rayleigh criterion for limit of resolution, Resolving and Dispersive power of a grating with expression (no derivation)

#### Module 3

##### Quantum Mechanics & Nanotechnology

Introduction for the need of Quantum mechanics, Wave nature of Particles, Uncertainty principle, Applications-Absence of electrons inside a nucleus and Natural line broadening Mechanism, Formulation of time dependent and independent Schrodinger wave equations-Physical Meaning of wave function, Particle in a one dimensional box- Derivation for normalised wave function and energy eigen values, Quantum Mechanical Tunnelling (Qualitative)

Introduction to nanoscience and technology, Increase in surface to volume ratio for nanomaterials, Quantum confinement in one dimension, two dimension and three dimension-Nano sheets, Nano wires and Quantum dots, Properties of nanomaterials-mechanical, electrical and optical, Applications of nanotechnology (qualitative ideas)

#### Module 4

##### Acoustics & Ultrasonics

Acoustics, Classification of sound-Musical sound-Noise, Characteristics of Musical Sounds-Pitch or frequency-Loudness or Intensity-Measurement of Intensity level-Decibel-Quality or timbre, Absorption coefficient, Reverberation-Reverberation time-Significance- Sabine's formula (no derivation), Factors affecting architectural acoustics and their remedies

Ultrasonics-Production- Magnetostriction effect and Piezoelectric effect, Magnetostriction oscillator and Piezoelectric oscillator -Working, Detection of ultrasonic waves - Thermal and Piezoelectric

methods, Ultrasonic diffractometer- Expression for the velocity of ultrasonic waves in a liquid , Applications of ultrasonic waves -SONAR,NDT and Medical

## **Module 5**

### **Laser and Fibre optics**

Properties of laser, Absorption and emission of radiation, Spontaneous and stimulated emission, Einstein's coefficients (no derivation), Population inversion, Metastable states, basic components of laser, Active medium, Pumping mechanism, Optical resonant cavity, working principle, Construction and working of Ruby laser and Helium neon laser ,Construction and working of semiconductor laser(Qualitative) ,Applications of laser, Holography, Difference between hologram and photograph, Recording of hologram and reconstruction of image, Applications

Optic fibre-Principle of propagation of light, Types of fibres-Step index and Graded index fibres, Numerical aperture –Derivation, Fibre optic communication system (block diagram), Industrial, Medical and Technological applications, Fibre optic sensors-Intensity Modulated and Phase modulated sensors

### **Text Books**

1. M.N.Avadhanulu, P.G.Kshirsagar,TVS Arun Murthy "A Text book of Engineering Physics", S.Chand &Co., Revised Edition, 2019.
2. H.K.Malik , A.K. Singh, "Engineering Physics" McGraw Hill Education, Second Edition, 2017.

### **Reference Books**

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2. D.K. Bhattacharya, Poonam Tandon, "Engineering Physics", Oxford University Press, 2015
3. Md.N.Khan & S.Panigrahi "Principles of Engineering Physics 1&2", Cambridge University Press, 2016
4. Aruldhas G., "Engineering Physics", PHI Pvt. Ltd., 2015
5. Ajoy Ghatak, "Optics", Mc Graw Hill Education, Sixth Edition, 2017
6. T. Pradeep, "Nano:The Essentials", McGraw Hill India Ltd, 2007
7. B. B. Laud, "Lasers and Non linear optics", New age International Publishers, 2nd Edition ,2005
8. Premlet B., "Advanced Engineering Physics", Phasor Books,10<sup>th</sup> edition ,2017
9. I. Dominic and. A. Nahari, "A Text Book of Engineering physics", Owl Books Publishers, Revised edition, 2016

### Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	<b>Oscillations and Waves ( 9 hours)</b>	
1.1	Harmonic oscillations, Damped harmonic motion-Derivation of differential equation and its solution, Over damped, Critically damped and Under damped Cases, Quality factor-Expression	2 hrs
1.2	Forced oscillations-Differential Equation-Derivation of expressions for amplitude and phase of forced oscillations, Amplitude Resonance-Expression for Resonant frequency, Quality factor and Sharpness of Resonance, Electrical analogy of mechanical oscillators	3hrs
1.3	Wave motion- Derivation of one dimensional wave equation and its solution, Three dimensional wave equation and its solution (no derivation)	2 hrs
1.4	Distinction between transverse and longitudinal waves, Transverse vibration in a stretched string, Statement of laws of vibration	2 hrs
2	<b>Wave Optics (9 hours)</b>	
2.1	Interference of light-Principle of superposition of waves, Theory of thin films - Cosine law (Reflected system), Derivation of the conditions of constructive and destructive Interference	2 hrs
2.2	Interference due to wedge shaped films -Determination of thickness and test for optical planeness, Newton's rings - Measurement of wavelength and refractive index, Antireflection coatings	4 hrs
2.3	Diffraction of light, Fresnel and Fraunhofer classes of diffraction, Diffraction grating-Grating equation	2 hrs
2.4	Rayleigh criterion for limit of resolution, Resolving and Dispersive power of a grating with expression (no derivation)	1 hr
3	<b>Quantum Mechanics &amp; Nanotechnology (9hours)</b>	
3.1	Introduction for the need of Quantum mechanics, Wave nature of Particles, Uncertainty principle, Applications-Absence of electrons inside a nucleus and Natural line broadening mechanism	2 hrs
3.2	Formulation of time dependent and independent Schrodinger wave equations-Physical Meaning of wave function, Particle in a one dimensional box- Derivation for normalised wave function and energy eigen values, Quantum Mechanical Tunnelling (Qualitative)	4 hrs
3.3	Introduction to nanoscience and technology, Increase in surface to volume ratio for nanomaterials, Quantum confinement in one dimension, two dimension and three dimension-Nano sheets, Nano wires and Quantum dots	2 hrs
3.4	Properties of nanomaterials-mechanical, electrical and optical Applications of nanotechnology (qualitative ideas)	1 hr
4	<b>Acoustics &amp; Ultrasonics (9hrs)</b>	
4.1	Acoustics, Classification of sound-Musical sound-Noise, Characteristics	3 hrs

	of Musical Sounds-Pitch or frequency-Loudness or Intensity-Measurement of Intensity level-Decibel-Quality or timbre, Absorption coefficient, Reverberation-Reverberation time-Significance- Sabine's formula (no derivation)	
4.2	Factors affecting architectural acoustics and their remedies	1 hr
4.3	Ultrasonics-Production- Magnetostriction effect and Piezoelectric effect, Magnetostriction oscillator and Piezoelectric oscillator – Working, Detection of ultrasonic waves - Thermal and Piezoelectric methods	3hrs
4.4	Ultrasonic diffractometer- Expression for the velocity of ultrasonic waves in a liquid ,Applications of ultrasonic waves -SONAR,NDT and Medical.	2 hr
5	<b>Laser and Fibre optics ( 9hours)</b>	
5.1	Properties of laser, Absorption and emission of radiation, Spontaneous and stimulated emission, Einstein's coefficients (no derivation), Population inversion, Metastable states, basic components of laser, Active medium, Pumping mechanism, Optical resonant cavity, working principle	2 hrs
5.2	Construction and working of Ruby laser and Helium neon laser ,Construction and working of semiconductor laser(Qualitative) Applications of laser	3 hrs
5.3	Holography, Difference between hologram and photograph, Recording of hologram and reconstruction of image, Applications	1 hr
5.4	Optic fibre-Principle of propagation of light, Types of fibres-Step index and Graded index fibres, Numerical aperture –Derivation, Fibre optic communication system (block diagram), Industrial, Medical and Technological applications, Fibre optic sensors-Intensity Modulated and Phase modulated sensors	3 hrs

PHL 120	ENGINEERING PHYSICS LAB	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		BSC	0	0	2	1	2019

**Preamble:** The aim of this course is to make the students gain practical knowledge to co-relate with the theoretical studies and to develop practical applications of engineering materials and use the principle in the right way to implement the modern technology.

**Prerequisite:** Higher secondary level Physics

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

CO 1	Develop analytical/experimental skills and impart prerequisite hands on experience for engineering laboratories
CO 2	Understand the need for precise measurement practices for data recording
CO 3	Understand the principle, concept, working and applications of relevant technologies and comparison of results with theoretical calculations
CO 4	Analyze the techniques and skills associated with modern scientific tools such as lasers and fiber optics
CO 5	Develop basic communication skills through working in groups in performing the laboratory experiments and by interpreting the results

#### Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3				3			1	2			1
CO 2	3				3			1	2			1
CO 3	3				3			1	2			1
CO 4	3				3			1	2			1
CO 5	3				3			1	2			1

#### Mark distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration(Internal)
100	100	-	1 hour

### **Continuous Internal Evaluation Pattern:**

Attendance	: 20 marks
Class work/ Assessment/Viva-voce	: 50 marks
End semester examination (Internally by college)	: 30 marks

**End Semester Examination Pattern:** Written Objective Examination of one hour

### **SYLLABUS**

#### **LIST OF EXPERIMENTS**

**(Minimum 8 experiments should be completed)**

1. CRO-Measurement of frequency and amplitude of wave forms
2. Measurement of strain using strain gauge and wheatstone bridge
3. LCR Circuit – Forced and damped harmonic oscillations
4. Melde's string apparatus- Measurement of frequency in the transverse and longitudinal mode
5. Wave length measurement of a monochromatic source of light using Newton's Rings method.
6. Determination of diameter of a thin wire or thickness of a thin strip of paper using air wedge method.
7. To measure the wavelength using a millimeter scale as a grating.
8. Measurement of wavelength of a source of light using grating.
9. Determination of dispersive power and resolving power of a plane transmission grating
10. Determination of the particle size of lycopodium powder
11. Determination of the wavelength of He-Ne laser or any standard laser using diffraction grating
12. Calculate the numerical aperture and study the losses that occur in optical fiber cable.
13. I-V characteristics of solar cell.
14. LED Characteristics.
15. Ultrasonic Diffractometer- Wavelength and velocity measurement of ultrasonic waves in a liquid
16. Deflection magnetometer-Moment of a magnet- Tan A position.

### **Reference books**

1. S.L.Gupta and Dr.V.Kumar, "Practical physics with viva voice", Pragati Prakashan Publishers, Revised Edition, 2009
2. M.N.Avadhanulu, A.A.Dani and Pokely P.M, "Experiments in Engineering Physics", S.Chand&Co,2008
3. S. K. Gupta, "Engineering physics practicals", Krishna Prakashan Pvt. Ltd., 2014
4. P. R. Sasikumar "Practical Physics", PHI Ltd., 2011.




[\(..\Institute\Welcome.aspx\)](#)

Vidya Academy of Science & Technology,  
 Thalakkottukara P.O, Thrissur, Kerala - 680501

[principal@vidyaacademy.ac.in](mailto:principal@vidyaacademy.ac.in) (..\Institute\Welcome.aspx)

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## Part B

[Back To Content Page](#)

### 5 FACULTY INFORMATION AND CONTRIBUTIONS (200)

[Open Separately \(eSARUGTierIIQuestion.aspx?Appid=4237&Progid=641&QuestID=48\)](#)

Note: Please provide cumulative information for all the shifts for three assessment years in below format in AnnexureII.

Name	PAN No.	University Degree	Date of Receiving Degree	Area of Specialization	Research Paper Publications	Ph.D Guidance	Ph.D. granted during the Assessment Year	Current Designation	Date (Designated as Prof./Assoc. Prof.).	Ini Dai Joi
Dr. Saji C B	AGSPB4124G	ME/M. Tech and PhD	25/07/2008	Thermal Engineering	<input type="text"/>	<input type="text"/>	<input type="text"/>	Professor	04/07/2018	04/
Dr. N Ramachandran	ABGPN0531L	M.Sc. (Engineering) and PhD	31/03/1997	Unconventional Machining	<input type="text"/>	<input type="text"/>	<input type="text"/>	Professor	02/09/2017	02/
Mr. Biju P V	ALDPB0673Q	M.E/M.Tech	14/05/2002	Production (Mechanical) Engineering	<input type="text"/>	<input type="text"/>	<input type="text"/>	Associate Professor	01/04/2013	10/
Mr. Rajesh N P	AJLPR1647N	M.E/M.Tech	11/11/2005	Thermal Science	<input type="text"/>	<input type="text"/>	<input type="text"/>	Associate Professor	02/01/2012	03/
Dr. Sooraj K Prabha	BKJPS0443K	ME/M. Tech and PhD	16/12/2013	Gas dynamics, Micro Fluidics	<input type="text"/>	<input type="text"/>	<input type="text"/>	Associate Professor	03/07/2013	03/
Dr. Rakesh Hari	AUIPR5560L	ME/M. Tech and PhD	30/07/2018	Thermal Systems	<input type="text"/>	<input type="text"/>	<input type="text"/>	Associate Professor	01/01/2019	01/
Mr. Vibin Antony P	AIHPV0238J	M.E/M.Tech	06/08/2008	Propulsion Engineering (Mechanical)	<input type="text"/>	<input type="text"/>	<input type="text"/>	Assistant Professor		18/
Mr. Alex Chacko C	AQLPA2657C	M.E/M.Tech	04/07/2014	Welding Engineering	<input type="text"/>	<input type="text"/>	<input type="text"/>	Assistant Professor		01/
Mr. Hareesh K	BZFPK9160C	M.E/M.Tech	10/11/2014	Engineering Design	<input type="text"/>	<input type="text"/>	<input type="text"/>	Assistant Professor		13/

Mr. Bhavin K Bharath	AZAPB8565C	M.E/M.Tech	03/08/2010	Manufacturing Engineering	<input type="text"/>	<input type="text"/>	<input type="text"/>	Assistant Professor		26/
Mr. R Shankar	AHXPR9156N	M.E/M.Tech	30/11/2010	Technology Management	<input type="text"/>	<input type="text"/>	<input type="text"/>	Assistant Professor		03/
Mr. Sarath Babu Ramachandran	BHHPR4922B	M.E/M.Tech	30/11/2013	Manufacturing Engineering	<input type="text"/>	<input type="text"/>	<input type="text"/>	Assistant Professor		02/
Mr. Arun K L	AJFPL8163K	M.E/M.Tech	30/11/2013	Manufacturing Engineering	<input type="text"/>	<input type="text"/>	<input type="text"/>	Assistant Professor		02/
Mr. Praveen A P	BXMPP7249C	M.E/M.Tech	13/05/2013	Machine Design	<input type="text"/>	<input type="text"/>	<input type="text"/>	Assistant Professor		16/
Mr. Aadars M S	AQSPA4498E	M.E/M.Tech	13/07/2013	Industrial Safety	<input type="text"/>	<input type="text"/>	<input type="text"/>	Assistant Professor		15/
Mr. Midhun P	CLLPP3387D	M.E/M.Tech	20/09/2014	Propulsion Engineering (Mechanical)	<input type="text"/>	<input type="text"/>	<input type="text"/>	Assistant Professor		08/
Mr. Anil Paul	BIOPP1863P	M.E/M.Tech	17/01/2015	Industrial Ceramics	<input type="text"/>	<input type="text"/>	<input type="text"/>	Assistant Professor		20/
Mr. Rahul V R	BHPPR6501Q	M.E/M.Tech	25/04/2016	Thermal Sciences	<input type="text"/>	<input type="text"/>	<input type="text"/>	Assistant Professor		07/
Mr. Cinto P A	BCQPP9137C	M.E/M.Tech	30/09/2014	Manufacturing Systems Management	<input type="text"/>	<input type="text"/>	<input type="text"/>	Assistant Professor		03/
Mr. Prasanth A B	CVRPP9562Q	M.E/M.Tech	15/11/2014	Materials Engineering	<input type="text"/>	<input type="text"/>	<input type="text"/>	Assistant Professor		01/
Mr. Ranjith E R	BKQPR2384K	M.E/M.Tech	05/12/2015	Internal Combustion Engines and Turbo machinery	<input type="text"/>	<input type="text"/>	<input type="text"/>	Assistant Professor		27/
Mr. Deepu Mohan	BRVPD5712R	M.E/M.Tech	14/11/2015	Thermal Engineering	<input type="text"/>	<input type="text"/>	<input type="text"/>	Assistant Professor		01/
Mr. Anu Prasad V A	CHBPA5677B	M.E/M.Tech	22/04/2017	Thermal Science	<input type="text"/>	<input type="text"/>	<input type="text"/>	Assistant Professor		04/
Mr. Vishnu Shaji	FBHPS8711K	M.E/M.Tech	30/01/2016	Manufacturing Engineering	<input type="text"/>	<input type="text"/>	<input type="text"/>	Assistant Professor		05/
Mr. Aneesh Karunakaran	AJCPA0115D	M.E/M.Tech	20/01/2012	Thermal Sciences	<input type="text"/>	<input type="text"/>	<input type="text"/>	Assistant Professor		15/
Mr. Farish K A	BZPPA5478M	M.E/M.Tech	04/06/2018	Manufacturing Systems Management	<input type="text"/>	<input type="text"/>	<input type="text"/>	Assistant Professor		01/
Mr. Shaheer P V	MDJPS5122H	M.E/M.Tech	04/06/2018	Production Engineering	<input type="text"/>	<input type="text"/>	<input type="text"/>	Assistant Professor		05/
Mr. Pillu V Mohan	BZXP5197A	M.E/M.Tech	15/11/2014	Thermal Engineering	<input type="text"/>	<input type="text"/>	<input type="text"/>	Assistant Professor		29/
Dr. V. Jayaraman	ACXPV8229M	ME/M. Tech and PhD	04/05/1983	Aerinautical Engineering	<input type="text"/>	<input type="text"/>	<input type="text"/>	Professor	01/02/2017	01/

### 5.1 Student-Faculty Ratio (20)

Institute Marks

S:F ratio = N/F; N = No. of students = 3\*X where x is (approved intake + 20% lateral entry intake + separate division, if any)  
 F = No. of faculty = (a+b-c) for every assessment year

- a: Total number of full-time regular Faculty serving fully to 2nd, 3rd and 4th year of the this program
- b: Total number of full-time equivalent regular Faculty(considering fractional load) serving this program from other Program(s)
- c: Total number of fulltime equivalent regular Faculty(considering fractional load )of this program serving other program(s)

Regular Faculty means:

- Fulltime on roll with prescribed payscale. An employee on contract for a period of more than two years AND drawing consolidated salary more than applicable gross salary shall only be counted as a regular employee.
- Prescribed pay scales means pay scales notified by the AICTE/ Central Government and implementation as prescribed by the State Government. In case State Government prescribes lesser consolidated salary for a particular cadre then same will be considered as reference while counting faculty as a regular faculty.

Marks to be given proportionally from a maximum of 20 to a minimum of 10 for average SFR between 15:1 to 20:1, and zero for average SFR higher than 20:1.

## UG

No. of UG Programs in the Department

B TECH (MECHANICAL ENGINEERING)						
Year of Study	CAY		CAYm1		CAYm2	
	(2019-20)		(2018-19)		(2017-18)	
	Sanction Intake	Actual admitted through lateral entry students	Sanction Intake	Actual admitted through lateral entry students	Sanction Intake	Actual admitted through lateral entry students
2nd Year	120	25	120	22	120	14
3rd Year	120	22	120	14	120	12
4th Year	120	14	120	12	120	12
<b>Sub-Total</b>	<b>360</b>	<b>61</b>	<b>360</b>	<b>48</b>	<b>360</b>	<b>38</b>
<b>Total</b>	<b>421</b>		<b>408</b>		<b>398</b>	

Grand Total	<input type="text" value="421"/>	<input type="text" value="408"/>	<input type="text" value="398"/>
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## PG

No. of PG Programs in the Department

Grand Total	<input type="text"/>	<input type="text"/>	<input type="text"/>
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## SFR

No. of UG Programs in the Department No. of PG Programs in the Department 

Description	CAY(2019-20)	CAYm1 (2018-19)	CAYm2 (2017-18)
Total No. of Students in the Department(S)	<input type="text" value="421"/> <b>Sum total of all (UG+PG) students</b>	<input type="text" value="408"/> <b>Sum total of all (UG+PG) students</b>	<input type="text" value="398"/> <b>Sum total of all (UG+PG) students</b>
No. of Faculty in the Department(F)	<input type="text" value="26"/> <b>F1</b>	<input type="text" value="23"/> <b>F2</b>	<input type="text" value="22"/> <b>F3</b>
Student Faculty Ratio(SFR)	<input type="text" value="16.19"/> <b>SFR1=S1/F1</b>	<input type="text" value="17.74"/> <b>SFR2=S2/F2</b>	<input type="text" value="18.09"/> <b>SFR3=S3/F3</b>
Average SFR	<input type="text" value="17.34"/> <b>SFR=(SFR1+SFR2+SFR3)/3</b>		
<b>F=Total Number of Faculty Members in the Department (excluding first year faculty)</b>			

**Note:** 75% should be Regular/full time faculty and the remaining shall be Contractual Faculty/Adjust Faculty/Resource persons from industry as per AICTE norms and standards. The contractual faculty will be considered for assessment only if a faculty is drawing a salary as prescribed by the concerned State Government for the contractual faculty in the respective cadre.

5.1.1. Provide the information about the regular and contractual faculty as per the format mentioned below:

	Total number of regular faculty in the department	Total number of contractual faculty in the department
CAY(2019-20)	23	3
CAYm1(2018-19)	23	0
CAYm2(2017-18)	22	0

Average SFR for three assessment years : 17.34

Assessment SFR : 16

---

5.2 Faculty Cadre Proportion (25)

Open Separately (eSARUGTierIIQuestion.aspx?Appid=4237&Progid=641&QuestID=50)

Institute Marks

15.00

The reference Faculty cadre proportion is 1(F1):2(F2):6(F3)

F1: Number of Professors required =  $1/9 \times$  Number of Faculty required to comply with 20:1 Student-Faculty ratio based on no. of students(N) as per 5.1

F2: Number of Associate Professors required =  $2/9 \times$  Number of Faculty required to comply with 20:1 Student-Faculty ratio based on no. of students(N) as per 5.1

F3: Number of Assistant Professors required =  $6/9 \times$  Number of Faculty required to comply with 20:1 Student-Faculty ratio based on no. of students(N) as per 5.1

Save

Year	Professors		Associate Professors		Assistant Professors	
	Required F1	Available	Required F2	Available	Required F3	Available
CAY(2019-20)	2	2	4	2	14	19
CAYm1(2018-19)	2	2	4	1	13	20
CAYm2(2017-18)	2	0	4	1	13	21
Average Numbers	2.00	1.00	2.00	1.00	2.00	2.00

**Cadre Ratio Marks :**  $[(AF1 / RF1) + [(AF2 / RF2) * 0.6] + [(AF3 / RF3) * 0.4]] * 12.5 : 15.00$

### 5.3 Faculty Qualification (25)

Open Separately (eSARUGTierIIQuestion.aspx?Appid=4237&Progid=641&QuestID=51)

Institute Marks

14.04

$FQ = 2.5 \times [(10X + 4Y) / F]$

where X is no. of regular faculty with Ph.D.,

Y is no. of regular faculty with M.Tech.,

F is no. of regular faculty required to comply 20:1 Faculty Student ratio(no. of faculty and no. of students required are to be calculated as per 5.1)

Save

	X	Y	F	$FQ = 2.5 \times [(10X + 4Y) / F]$
2019-20(CAY)	4	22	21	15.24
2018-19(CAYm1)	4	19	20	14.50
2017-18(CAYm2)	1	21	19	12.37

Average Assessment : 14.04

### 5.4 Faculty Retention (25)

Open Separately (eSARUGTierIIQuestion.aspx?Appid=4237&Progid=641&QuestID=52)

Institute Marks

25

Save

Description	2018-19	2019-20
No of Faculty Retained	21	20
Total No of Faculty	22	22
% of Faculty Retained	95	91

Average : 93

Assessment Marks : 25

---

#### 5.5 Innovations by the Faculty in Teaching and Learning (20)

Open Separately (eSARUGTierIIQuestion.aspx?Appid=4237&Progid=641&QuestID=53)

Institute Marks

Write Answer

---

#### 5.6 Faculty as participants in Faculty development/training activities/STTPs (15)

Open Separately (eSARUGTierIIQuestion.aspx?Appid=4237&Progid=641&QuestID=54)

Institute Marks

Note : Please save the SFR entry from 5.1 to calculate Sum

Name of the faculty	Max 5 Per Faculty			Action
	2018-19 (CAYm1)	2017-18 (CAYm2)	2016-17 (CAYm3)	
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	Delete

Average assessment over 3 years:

### 5.7 Research and Development (30)

5.7.1 Academic Research (10)

Institute Marks

Academic research includes research paper publications, Ph.D. guidance, and faculty receiving Ph.D. during the assessment period.

- Number of quality publications in refereed/ SCI Journals, citations, Books/ Book Chapters etc.(6)
- Ph.D. guided / Ph.D. awarded during the assessment period while working in the institute(4)

All relevant details shall be mentioned.

5.7.2 Sponsored Research (5)

Institute Marks

**2018-19 (CAYm1)**

Save Add Row

Project Title	Duration	Funding Agency	Amount	Action
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	Delete

**2017-18 (CAYm2)**

Save Add Row

Project Title	Duration	Funding Agency	Amount	Action
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	Delete

**2016-17 (CAYm3)**

Save Add Row

Project Title	Duration	Funding Agency	Amount	Action
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	Delete

Cumulative Amount(X + Y + Z) =

5.7.3 Development Activities (10)

Institute Marks

Provide details:

- ProductDevelopment
- Researchlaboratories
- Instructionalmaterials
- Workingmodels/charts/monogramsetc.

5.7.4 Consultancy(from Industry) (5)

Institute Marks



(Provide a list with Project Title, Funding Agency, Amount and Duration) Funding amount(Cumulative during assessment years)

**2018-19 (CAYm1)**

Project Title	Duration	Funding Agency	Amount	Action
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	Delete

**2017-18 (CAYm2)**

Project Title	Duration	Funding Agency	Amount	Action
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	Delete

**2016-17 (CAYm3)**

Project Title	Duration	Funding Agency	Amount	Action
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	Delete

Cumulative Amount(X + Y + Z) =

5.8 Faculty Performance Appraisal and Development System (FPADS) (30)

Institute Marks

5.9 Visiting/Adjunct/Emeritus Faculty etc. (10)

Open Separately (eSARUGTierIIQuestion.aspx?Appid=4237&ProgId=641&QuestID=60)

Institute Marks

Write Answer



Previous

Next

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# **Faculty Performance Appraisal System**

## **Akamai University**

### **A. University Position Statement**

Akamai faculty supervisors and the administration conduct periodic performance appraisals of all members of the faculty relative to quality of guidance, instruction, curriculum, scholarship, research, and systems. The goal of the University in assessing its faculty is to identify and correct inefficiencies within its operating systems and provide the necessary direction and guidance in support of each individual faculty member for assurance of quality and integrity. Akamai's faculty appraisal system is meant to highlight areas where faculty members have encountered difficulties in the conduct of their duties or assignments and provide solutions and guidance to assure achievement of standards and expectancies.

Faculty members are assessed in relation to the University's expectations of its faculty in the areas of faculty standards, program operations, and the University's policies on ethics and professional behavior. Assessment of program operations should focus upon orientation of the student, planning of student degree activities, course planning and delivery, and proper conduct of the program, reporting of student progress, and maintenance of quality standards. Faculty quality standards are published and available online together with the University's Code of Ethics and Professional Behavior. When faculty members have experienced little or no difficulty in carrying out these responsibilities, they receive a favorable status report in the permanent record.

The administration will contact faculty members who experience difficulties in achieving academic standards and expectations for dialogue and reorientation. Faculty supervisors may also make similar contact with faculty under their direction. A frequent need for specific interventions will highlight for the administration those areas within the program structure that need detailed attention and possible rework. When a specific faculty member continues to experience failure in meeting expectations and is unable to make the necessary adjustments, the President will consider discontinuing assignment of students. The Administration will consider this resolution only as a final action, after careful intervention, and further orientation and in-service for the faculty member.

### **B. General Guidelines for Faculty Appraisals**

It is the policy of the University that the job performance of each member of the faculty be evaluated periodically by the faculty supervisors or administration of the University.

1. Faculty performance appraisal is a written evaluation of the faculty member's job performance. It may include: the supervisor's comments and recommendations, an action plan for both employee and supervisor, and performance goals for the next evaluation period. Information derived from the performance appraisal shall be considered when making decisions affecting a faculty member concerning training needs, continued assignments, and opportunities for advancement.

2. Performance appraisals should be completed upon the following occasions:
  - a. After the initial probationary period.
  - b. On or about each anniversary date of employment;
  - c. When the faculty member is transferred or promoted to a new position;
  - d. When the faculty member is assigned to a new supervisor;
  - e. At the time of the faculty member is to be termination, if a disciplinary or termination report is not prepared; and
  - f. Whenever deemed appropriate by the University administration.
3. Faculty supervisors are strongly encouraged to keep informal written records of significant events concerning the job performance of faculty members under their supervision.
4. When commenting a faculty member's overall performance during the evaluation period, supervisors may consider factors such as:
  - a. The experience and training of the faculty member
  - b. The job description and the faculty member's attainment of previously set objectives and goals.
  - c. Other factors that normally should be considered in the performance appraisal include, but are not limited to:
    - Knowledge of the job
    - Quantity and quality of work
    - Promptness in completing assignments
    - Cooperation
    - Initiative
    - Reliability
    - Attendance
    - Judgment
    - Acceptance of responsibility.
5. Senior administrators should review the supervisor's written evaluation to help assure that the evaluation function has been properly completed in a fair and objective manner.
6. After the written evaluation has been reviewed by the supervisor and the faculty member, and recorded at the University headquarters, the supervisor and senior administrator should discuss the evaluation; assess the employee's strengths and weaknesses in a constructive manner, and set objectives and goals for the period ahead. The employee should be given the opportunity to examine the written evaluation and make written comments about any aspect of it. The employee and supervisor will then sign and date the evaluation and forward it to the Office of the President for inclusion in the faculty member's archival record.

7. If the written evaluation contains an unfavorable commentary or rating, which the faculty member believes unfair or unjustified, and the matter has not been resolved to the employee's satisfaction during the discussion with the supervisor, the employee may take further action by using the regular grievance procedure. If an employee refuses to sign the evaluation, a third party, who is not privy to the contents of the evaluation, shall, in place of the employee, sign as a witness to the fact that the employee refused.
8. Nothing contained in this policy should be construed to prohibit or discourage supervisors from discussing an faculty member's job performance on an informal basis, whenever the need arises.
9. The procedures discussed in this policy are intended as guidelines. The University President or Board of Directors may unilaterally modify or revoke them in whole or in part from time to time. Accordingly, these procedures are not a promise or contract, express or implied, that they will be used in every instance.
10. If the faculty member continues to perform duties in an unsatisfactory manner, after adequate opportunities to correct the unsatisfactory work performance or ineffective behaviors, administration will terminate the services of the faculty member and eliminate future student assignments. Administration reserves the right to terminate at will where necessary and at the time they deem appropriate.

### **C. Procedures for Verifying Quality of Faculty**

The procedures for verifying the quality of faculty fall into two main categories. The **first** is inherent within the process for hiring, assignment, and promotion of faculty. The **second** is contained within the faculty appraisal system now established.

#### **1. Summary Guidelines for Hiring, Assignment, and Promotion.**

Applications for adjunct faculty positions include a request for documentation by the University related to contact information, a full resume or CV, a brief biographical sketch, educational transcripts, letters of reference, and a recent photograph. These materials are reviewed to demonstrate for the review committee the candidate's preparation and career experience relative to the job functions.

Initial applications for faculty positions are received and reviewed for completeness by the Office of the President. Complete materials are then distributed to a faculty review panel, which includes the immediate supervisor of the position in question, a member of the senior staff, and an assigned representative of the Office of the President, as appropriate. The President is included in review panels for all appointments and promotions of directors and senior academic staff.

Faculty applications are reviewed and sorted according to the strength of the candidates' academic background and professional experience relative to the expectations of the job functions for the position in question. For competitive situations, candidates are culled to

three and references are consulted, as needed, to verify the fitness of each candidate for the position under consideration. The final candidates are interviewed by members of the faculty review panel and again ranked according to the fitness of the candidates for the expectations of the position. Due to the virtual nature of the University, electronic modes of meetings and communications are to be used.

All appointments involve a 90-day probationary period during which faculty newly hired or promoted are given a full and extensive orientation by supervisors and assessment for fitness to continue in the position.

## **2. Summary Guidelines on Faculty Appraisals**

The goal of the University in assessing its faculty is to determine their effectiveness for employment, and to identify and correct inefficiencies within the operating systems of the institution. Where possible, the administration will seek to provide the necessary direction and guidance in support of each individual faculty member. The University's appraisal system, therefore, is meant to highlight areas where faculty members have encountered difficulties in the conduct of their duties or assignments, and to ascertain the appropriateness of their performance and/or behavior for their particular role within the University and identify remedies and in-service opportunities.

### **D. System of Faculty Appraisal**

In summary, faculty appraisal is conducted as a means to enhance the job performance of each individual faculty member and as a route to improvement of the organizational effectiveness and overall operation of the University. It is further designed to reinforce the "team management" approach and validate management's commitment to a mutually supportive environment. The appraisal process is designed to gather vital information and measurements about staff activities and University operations useful to management's purpose in bettering the faculty output, working conditions, faculty morale, and inner workings of the University community as a whole.

The Faculty Appraisal System is a six-fold process including the following elements:

- Appraisal Element #1: Self-Assessment
- Appraisal Element #2: Assessment of Working Conditions
- Appraisal Element #3: Reassessment of Position Description
- Appraisal Element #4: Supervisory Assessment
- Appraisal Element #5: Faculty Development Plan
- Appraisal Element #6: In-service Plan

#### **Appraisal Element 1: Self-Assessment**

The Self-Assessment process allows faculty members to reflect upon their effectiveness in accomplishing their current job requirements and the responsibilities of their position with the University. Faculty are asked to assess their performance and growth in each self-assessment category, identifying areas where they are successful and areas where they are in need of improvement and in need of advisement and further in-service training. If there are certain aspects of performance in each category that receive a self-assessment rating of

satisfactory, good, very good or outstanding, the staff member should identify these areas and clarify the response. If the self-assessment rating of certain aspects in each category are rated “need of improvement” or “unsatisfactory,” identify these areas and explain the difficulties.

**a. Job Knowledge**

Working knowledge of all phases of the job and the various techniques and skills needed for efficient completion of the tasks. Has remained up to date on changes in technical knowledge related to the discipline. Has expanded knowledge of the job and the University’s programs and services as it relates to the positions of service staff at the University

**b. Judgment**

Ability to make sound and proper decisions by drawing upon professional expertise with minimal negative effects on employee relations and University goals and outcomes  
Willingness to take responsibility for making these decisions

**c. Interpersonal Relationships**

Willingness and demonstrated ability to cooperate, work, and communicate with coworkers, management, and outside contacts and to make an unselfish contribution to improving the morale of the faculty, staff, and administration

**d. Verbal and Written Communication**

Effectiveness of expression in individual and group situations including listening, verbal and affective communication, and appropriate language and ability to express ideas clearly and concisely in good grammatical form and to successfully address the issues in the tasks at hand

**e. Coordination**

Ability to work with others as a team and express individual viewpoints and requirements from the perspective of the faculty position while considering and learning from the input of others

**f. Planning and Organization**

Ability to establish appropriate course of action for self and coworkers to accomplish goals Ability to make appropriate use of resources and the time of coworkers and set realistic target dates for the completion of important tasks

**g. Adherence to Policies and Procedures**

Ability to properly interpret and apply University policies and procedures and desired manner of operations to the responsibilities and tasks of the job

**h. Orientation Toward Results**

Ability to initiate projects, anticipate changes or needs, establish new priorities, follow through and meet deadlines

### **Appraisal Element #2: Assessment of Working Conditions**

The purpose for conducting the assessment of working conditions is to allow faculty to reflect upon the effects of the work organization and operation upon their job performance and the effectiveness of University operations.

Faculty members are asked to thoroughly assess the working conditions, the program and administrative systems and procedures, the flow of work, and the interplay of faculty, staff and administration, as required to successfully perform the tasks of their position. Faculty should assess the following elements:

**a. Supportive Working Conditions**

Identify aspects of the work environment that are especially supportive to the accomplishment of the various facets of the job.

**b. Detrimental Working Conditions**

Clearly explain factors within the work environment that hamper progress, delay completion, work against effectiveness or are counterproductive to the successful accomplishment of the tasks of the position.

**c. Suggested Improvements**

Suggest ways of operation that are clearly better and that would prove to be efficient for the University as a whole.

### **Appraisal Element #3: Reassessment of Position Description**

The purpose for conducting a reassessment of the faculty job description is to allow an assessment of the effectiveness of the employee's efforts in job tasks and their impact upon job performance, University efficiency, and the functionality of the work environment.

**a. Review of Faculty Job Description**

Faculty should review closely the written job description (as formally amended) under which they were hired. Point by point, the description of job responsibilities should be reviewed and matched against staff actual job responsibilities.

**b. Identifying Discrepancies**

Discrepancies should be clearly explained and the difficulties confronting staff due to the existence of these discrepancies should be identified as they relate to the job responsibilities.

**c. Duties and Responsibilities**

How have the job duties and responsibilities impacted the faculty member's ability to address the vital aspects of the job and the ability of the faculty member to perform well in all aspects of the job? Reflect on these issues in each of the eight areas highlighted in the staff self-assessment.



**d. Rewrite Job Description**

Staff should submit a rewrite of their job description as they envision it, to allow optimum performance of the vital aspects of their modification of job tasks to allow the faculty member to best address the important aspects of their position. In some cases, this may lead to the restructuring of the position description by the senior administration.

**Appraisal Element #4: Supervisory Assessment**

The purpose of this assessment is to provide staff with management's perspective on issues pertinent to staff performance.

**a. Supervisor Review of Faculty Input**

Supervisor will carefully review faculty input from self-assessment of performance, comments regarding the effects of the work environment on job performance, and the fitness and clarity of the job description to the tasks confronting the faculty member. This should also include a review of the staff development plans and corrective actions prescribed during any prior faculty appraisal.

**b. Management Consideration for Rebuttal of Faculty**

The management team will address areas where faculty overrate or underrate their performance in any aspect of the eight self-assessment categories, with discussion and agreement reached prior to response to the staff, reflecting an understanding of staff input with factual and informative determinations that address the issues directly. Management should gather the rebuttal of faculty as further valuable input to the management information process.

**c. Management Consideration for Working Conditions**

Management likewise shall discuss and reach a consensus in responding point for point to the faculty assessment of working conditions. In areas of agreement, such alterations in programs, systems and procedures should be outlined and agreed upon prior to response to the staff. In areas of disagreement, the management team shall jointly clearly state the perspective of management and offer the information needed for a joining of understandings.

**d. Management Consideration for Changes to Position Descriptions**

Management shall collaborate and respond in writing point for point in reply to faculty considerations of the job description, stating areas of agreement and disagreement, the perspective of management and offering the information needed for a joining of understandings.

**e. Summary Assessment of Faculty Performance**

Management shall draft and prepare a Summary Assessment of faculty performance from the perspective of management addressing each of the eight assessment categories. This written assessment is provided to faculty at least one week prior to the scheduled date for conferencing concerning the Faculty Staff Development Plan.

### **Appraisal Element #5 Faculty Development Plan**

The purpose of the Faculty Development Plan is to provide an opportunity for staff to participate in the design and development of plans for corrective actions that address all pertinent issues arising out of the staff evaluation process.

#### **a. Appropriateness of Meeting Schedule**

The meeting to discuss the appraisal should be scheduled at an appropriate time to assure faculty and supervisor can easily attend the electronic meeting. The meeting may be in person, by telephone, chat or discussion group, or a rapid exchange of email. All communications should be gathered and provided to the University's headquarters for storage in the faculty archive.

#### **b. Preparation for Electronic Meeting**

Faculty and supervisor should exchange and thoroughly review all appraisal reports and responses prior to the meeting and prepare and exchange a list of questions and issues to be covered.

#### **c. Conduct of Electronic Meeting**

Covering the vital issues or disagreements, point by point, management should lead the faculty member in a collaborative discussion of corrective actions to be undertaken by the staff member or management during the period following the assessment process. The results of the collaborative discussion should be reported in minutes to be maintained in the staff files. Corrective actions should include a specific description of the actions to be pursued and a timetable for accomplishment.

#### **d. In-Service Plan**

Those areas that cannot be corrected by the individual actions of faculty or management may be addressed by the In-service Plan as an important aspect of the Faculty Development Plan.

### **Appraisal Element #6: In-service Plan**

The purpose of the In-service Plan is to outline the acceptable means through which faculty will gain the skills, knowledge, and attitudes needed to address difficulties in job performance and working conditions.

#### **a. Importance of In-Service Plan**

In-service needs should be identified and prescribed at the Faculty Development Plan meeting and sources for such training actively pursued during the weeks immediately following the faculty appraisal process. The style of training selected should be commensurate with the funding available for such activities but should not be wholly disregarded due to lack of funding.

#### **b. Options for In-Service Plan**

Faculty development plans including corrective action plans may require in-service training for improvement of deficiencies in skills, concepts, understandings, and behavioral or attitudinal factors of job performance.

In-service plans may include further faculty orientation to the University policies and procedures, forms, standards and guidelines. One on one mentorship by the supervisor may be appointed as the necessary path to upgrading the competencies of the faculty member. If these are not a viable plan for the needs of the faculty member, the faculty member may elect at his or her expense, text or journal reading, video viewing, outside classes, seminars, or conferences.

**c. University-wide Faculty In-Service**

In certain instances determined by the Board and administration, in-service training may be conducted for the entire faculty at the expense of the University.

**E. Faculty Self-Assessment Guidelines**

**1. Eight Point Self-Assessment**

The faculty self-assessment contributes to administration's reflection upon effectiveness in operating procedures and faculty appointments.

**INSTRUCTIONS:** Assess your own performance and growth in each of the eight self-assessment categories below. Identify areas where you have experienced success and areas where you are in need of improvement within each category. Where there are aspects of performance that you rate satisfactory, good, very good, or outstanding, clarify these responses. Where your self-assessment rating within any category indicate a need for improvement or unsatisfactory achievement, clarify those areas and explain in detail the difficulties you have encountered. Your task is to prepare a written document, including your self-assessment in each category, justifying your responses. List your name and position at the top of the report. Sign and date the report at the end of the final page.

**a. Job Knowledge**

Working knowledge of all phases of the faculty appointment and the various techniques and skills needed for efficient completion of the tasks. Has remained up to date on changes in technical knowledge related to the discipline of instruction. Has expanded knowledge of the related professions and the University's programs and services as they relate to the position.

**b. Judgment.**

Ability to make sound and proper decisions by drawing upon professional expertise with minimal negative effects on University relations and quality academic goals and outcomes. Willingness to take responsibility for making cooperative decisions and actions.

**c. Interpersonal Relationships**

Demonstrated willingness and ability to effectively cooperate, exhibit teamwork in communication and with coworkers, supervisors, and administration, and to make unselfish contributions to improving the morale of the faculty, staff, and administration.

**d. Verbal and Written Communication**

Effectiveness of expression in individual and group situations including listening, use of appropriate language and ability to express ideas clearly and concisely in good grammatical form and to successfully address the issues in the tasks at hand.

**e. Coordination**

Ability to work with others as a team and express individual viewpoint and requirements from the perspective of the staff position while considering and learning from the input of others.

**f. Planning and Organization**

Ability to establish appropriate course of action for self and coworkers to accomplish goals and ability to make appropriate use of resources and the time of coworkers and set realistic target dates for the completion of important tasks.

**g. Adherence to Policies and Procedures**

Ability to properly interpret and apply University policies and procedures and take the needed actions to address the responsibilities and tasks of the job.

**h. Orientation towards Results**

Ability to initiate actions and projects, anticipate and adjust for changes or emerging needs, establish new priorities, follow through and meet deadlines.

**2. Assessment of Working Conditions**

The purpose for conducting an assessment of your working conditions is to better understand the effects of workplace organization and its impact upon your job performance and effectiveness upon University operations.

**INSTRUCTIONS:** Thoroughly assess your own work environment, administrative systems and procedures, the flow of work, and the interplay with University staff as required to successfully perform the tasks of your position. Identify aspects of the work environment that are especially supportive to the accomplishment of the various facets of your job. Explain factors within the work environment that hamper progress, delay completion, work against effectiveness or are counterproductive to the successful accomplishment of the tasks of the position. Suggest ways of operation that are clearly better and that would be more efficient for the University as a whole.

**3. Reassessment of Position Description**

The purpose for conducting a reassessment of your position description is to allow an assessment of the job tasks, effectiveness of your efforts, and the impact upon job performance, University efficiency, and the functionality of the work environment. Suggesting alteration of the position description and assigned tasks will provide essential information for management decisions regarding the most effective staffing arrangements and most efficient distribution of job tasks. Position alterations may serve to relieve certain staff of tasks for which their position is wholly unfit or for which another position would be better suited.

**INSTRUCTIONS:** Point for point, review and match your actual job duties and responsibilities with your written position description under which you were hired. Explain any discrepancies in your position as written in the job description and discuss the difficulties confronted due to the existence of these discrepancies. Prepare a rewrite of your position description as you envision it allowing for optimum performance of the vital aspects of your position, so you might best address the important aspects of your position.

<b>HUN 101</b>	<b>LIFE SKILLS</b>	<b>CATEGORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>CREDIT</b>	<b>YEAR OF INTRODUCTION</b>
		MNC	2	0	2	---	2019

**Preamble:** Life skills are those competencies that provide the means for an individual to be resourceful and positive while taking on life's vicissitudes. Development of one's personality by being aware of the self, connecting with others, reflecting on the abstract and the concrete, leading and generating change, and staying rooted in time-tested values and principles is being aimed at. This course is designed to enhance the employability and maximize the potential of the students by introducing them to the principles that underly personal and professional success, and help them acquire the skills needed to apply these principles in their lives and careers.

**Prerequisite:** None

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

<b>CO 1</b>	Define and Identify different life skills required in personal and professional life
<b>CO 2</b>	Develop an awareness of the self and apply well-defined techniques to cope with emotions and stress.
<b>CO 3</b>	Explain the basic mechanics of effective communication and demonstrate these through presentations.
<b>CO 4</b>	Take part in group discussions
<b>CO 5</b>	Use appropriate thinking and problem solving techniques to solve new problems
<b>CO 6</b>	Understand the basics of teamwork and leadership

#### Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
<b>CO 1</b>						2		1	2	2	1	3
<b>CO 2</b>									3			2
<b>CO 3</b>						1			1	3		
<b>CO 4</b>										3		1
<b>CO 5</b>		3	2	1								
<b>CO 6</b>						1			3			

#### Mark distribution

Total Marks	CIE	ESE	ESE Duration
100	50	50	2 hours

## Continuous Internal Evaluation

**Total Marks: 50**

Attendance	: 10 marks
Regular assessment	: 15 marks
Series test (one test only, should include first three modules)	: 25 marks

### Regular assessment

➤ **Group Discussion (Marks: 9)**

Create groups of about 6 students each and engage them on a GD on a suitable topic for about 20 minutes. Parameters to be used for evaluation are as follows:

- Communication Skills : 3 marks
- Subject Clarity : 2 marks
- Group Dynamics : 2 marks
- Behaviours & Mannerisms : 2 marks

➤ **Presentation Skills (Marks: 6)**

Identify a suitable topic and ask the students to prepare a presentation (preferably a power point presentation) for about 10 minutes. Parameters to be used for evaluation are as follows:

- Communication Skills : 2 marks
- Platform Skills : 2 marks
- Subject Clarity/Knowledge : 2 marks

### End Semester Examination

**Total Marks: 50**

**Time: 2 hrs.**

#### Part A: Short answer question (25 marks)

There will be one question from each MODULE (five questions in total, five marks each). Each question should be written in about maximum of 400 words. Parameters to be used for evaluation are as follows:

- (i) Content Clarity/Subject Knowledge
- (ii) Presentation style
- (iii) Organization of content

#### Part B: Case Study (25 marks)

The students will be given a case study with questions at the end. The students have to analyze the case and answer the question at the end. Parameters to be used for evaluation are as follows:

- (i) Analyze the case situation
- (ii) Key players/characters of the case
- (iii) Identification of the problem (both major & minor if exists)
- (iv) Bring out alternatives
- (v) Analyze each alternative against the problem
- (vi) Choose the best alternative
- (vii) Implement as solution
- (viii) Conclusion

(ix) Answer the question at the end of the case

### Course Level Assessment Questions

#### Course Outcome 1 (CO1):

1. List 'life skills' as identified by WHO
2. What do you mean by effective communication?
3. What are the essential life skills required by a professional?

#### Course Outcome 2 (CO2)

1. Identify an effective means to deal with workplace stress.
2. How can a student apply journaling to stress management?
3. What is the PATH method? Describe a situation where this method can be used effectively.

#### Course Outcome 3(CO3):

1. Identify the communication network structure that can be observed in the given situations. Describe them.
  - (a) A group discussion on development.
  - (b) An address from the Principal regarding punctuality.
  - (c) A reporter interviewing a movie star.
  - (d) Discussing the answers of a test with a group of friends.
2. Elucidate the importance of non-verbal communication in making a presentation
3. Differentiate between kinesics, proxemics, and chronemics with examples.

#### Course Outcome 4 (CO4):

1. How can a participant conclude a group discussion effectively?
2. 'Listening skills are essential for effectively participating in a group discussion.' Do you agree? Substantiate your answer.

#### Course Outcome 5 (CO5):

1. Illustrate the creative thinking process with the help of a suitable example
2. Translate the following problem from verbal to graphic form and find the solution : *In a quiz, Ananth has 50 points more than Bimal, Chinmay has 60 points less than Ananth, and Dharini is 20 points ahead of Chinmay. What is the difference in points between Bimal and Dharini?*

3. List at least five ways in which the problem "How to increase profit?" can be redefined

**Course Outcome 6 (CO6):**

1. A group of engineers decided to brainstorm a design issue on a new product. Since no one wanted to disagree with the senior members, new ideas were not flowing freely. What group dynamics technique would you suggest to avoid this 'groupthink'? Explain the procedure.
2. "A group focuses on individual contribution, while a team must focus on synergy." Explain.
3. Identify the type of group formed / constituted in each of the given situations
  - a) A Police Inspector with subordinates reporting to him
  - b) An enquiry committee constituted to investigate a specific incident
  - c) The Accounts Department of a company
  - d) A group of book lovers who meet to talk about reading

**Syllabus**

**Module 1**

Overview of Life Skills: Meaning and significance of life skills, Life skills identified by WHO: Self-awareness, Empathy, Critical thinking, Creative thinking, Decision making, problem solving, Effective communication, interpersonal relationship, coping with stress, coping with emotion.

Life skills for professionals: positive thinking, right attitude, attention to detail, having the big picture, learning skills, research skills, perseverance, setting goals and achieving them, helping others, leadership, motivation, self-motivation, and motivating others, personality development, IQ, EQ, and SQ

**Module 2**

Self-awareness: definition, need for self-awareness; Coping With Stress and Emotions, Human Values, tools and techniques of SA: questionnaires, journaling, reflective questions, meditation, mindfulness, psychometric tests, feedback.

Stress Management: Stress, reasons and effects, identifying stress, stress diaries, the four A's of stress management, techniques, Approaches: action-oriented, emotion-oriented, acceptance-oriented, resilience, Gratitude Training,

Coping with emotions: Identifying and managing emotions, harmful ways of dealing with emotions, PATH method and relaxation techniques.



Morals, Values and Ethics: Integrity, Civic Virtue, Respect for Others, Living Peacefully. Caring, Sharing, Honesty, Courage, Valuing Time, Time management, Co operation, Commitment, Empathy, Self-Confidence, Character, Spirituality, Avoiding Procrastination, Sense of Engineering Ethics.

### **Module 3**

21<sup>st</sup> century skills: Creativity, Critical Thinking, Collaboration, Problem Solving, Decision Making, Need for Creativity in the 21st century, Imagination, Intuition, Experience, Sources of Creativity, Lateral Thinking, Myths of creativity, Critical thinking Vs Creative thinking, Functions of Left Brain & Right brain, Convergent & Divergent Thinking, Critical reading & Multiple Intelligence.

Steps in problem solving: Problem Solving Techniques, Six Thinking Hats, Mind Mapping, Forced Connections. Analytical Thinking, Numeric, symbolic, and graphic reasoning. Scientific temperament and Logical thinking.

### **Module 4**

Group and Team Dynamics: Introduction to Groups: Composition, formation, Cycle, thinking, Clarifying expectations, Problem Solving, Consensus, Dynamics techniques, Group vs Team, Team Dynamics, Virtual Teams. Managing team performance and managing conflicts, Intrapreneurship.

### **Module 5**

Leadership: Leadership framework, entrepreneurial and moral leadership, vision, cultural dimensions. Growing as a leader, turnaround leadership, managing diverse stakeholders, crisis management. Types of Leadership, Traits, Styles, VUCA Leadership, Levels of Leadership, Transactional vs Transformational Leaders, Leadership Grid, Effective Leaders.

### **Lab Activities**

#### **Verbal**

Effective communication and Presentation skills.

Different kinds of communication; Flow of communication; Communication networks, Types of barriers; Miscommunication

Introduction to presentations and group discussions.

Learning styles: visual, aural, verbal, kinaesthetic, logical, social, solitary; Previewing, KWL table, active listening, REAP method

Note-taking skills: outlining, non-linear note-taking methods, Cornell notes, three column note taking.

Memory techniques: mnemonics, association, flashcards, keywords, outlines, spider diagrams and mind maps, spaced repetition.

Time management: auditing, identifying time wasters, managing distractions, calendars and checklists; Prioritizing - Goal setting, SMART goals; Productivity tools and apps, Pomodoro technique.

#### **Non Verbal:**

Non-verbal Communication and Body Language: Forms of non-verbal communication; Interpreting body-language cues; Kinesics; Proxemics; Chronemics; Effective use of body language, Communication in a multi cultural environment.

## Reference Books

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3. ICT Academy of Kerala, "Life Skills for Engineers", McGraw Hill Education (India) Private Ltd., 2016.
4. Caruso, D. R. and Salovey P, "The Emotionally Intelligent Manager: How to Develop and Use the Four Key Emotional Skills of Leadership", John Wiley & Sons, 2004.
5. Kalyana, "Soft Skill for Managers"; First Edition; Wiley Publishing Ltd, 2015.
6. Larry James, "The First Book of Life Skills"; First Edition, Embassy Books, 2016.
7. Shalini Verma, "Development of Life Skills and Professional Practice"; First Edition; Sultan Chand (G/L) & Company, 2014.
8. Daniel Goleman, "Emotional Intelligence"; Bantam, 2006.
9. Remesh S., Vishnu R.G., "Life Skills for Engineers", Ridhima Publications, First Edition, 2016.
10. Butterfield Jeff, "Soft Skills for Everyone", Cengage Learning India Pvt Ltd; 1 edition, 2011.
11. Training in Interpersonal Skills: Tips for Managing People at Work, Pearson Education, India; 6 edition, 2015.
12. The Ace of Soft Skills: Attitude, Communication and Etiquette for Success, Pearson Education; 1 edition, 2013.



MAT 101	LINEAR ALGEBRA AND CALCULUS	CATEGORY	L	T	P	CREDIT	Year of Introduction
		BSC	3	1	0	4	2019

**Preamble:** This course introduces students to some basic mathematical ideas and tools which are at the core of any engineering course. A brief course in Linear Algebra familiarises students with some basic techniques in matrix theory which are essential for analysing linear systems. The calculus of functions of one or more variables taught in this course are useful in modelling and analysing physical phenomena involving continuous change of variables or parameters and have applications across all branches of engineering.

**Prerequisite:** A basic course in one-variable calculus and matrix theory.

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

CO 1	solve systems of linear equations, diagonalize matrices and characterise quadratic forms
CO 2	compute the partial and total derivatives and maxima and minima of multivariable functions
CO 3	compute multiple integrals and apply them to find areas and volumes of geometrical shapes, mass and centre of gravity of plane laminas
CO 4	perform various tests to determine whether a given series is convergent, absolutely convergent or conditionally convergent
CO 5	determine the Taylor and Fourier series expansion of functions and learn their applications.

**Mapping of course outcomes with program outcomes**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	3	3	2	1			1	2		2
CO 2	3	3	3	3	2	1			1	2		2
CO 3	3	3	3	3	2	1			1	2		2
CO 4	3	2	3	2	1	1			1	2		2
CO 5	3	3	3	3	2	1			1	2		2

**Assessment Pattern**

Bloom's Category	Continuous Assessment Tests		End Semester Examination (Marks)
	Test 1 (Marks)	Test 2 (Marks)	
Remember	10	10	20
Understand	20	20	40
Apply	20	20	40
Analyse			
Evaluate			
Create			

### Mark distribution

Total Marks	CIE marks	ESE marks	ESE Duration
150	50	100	3 hours

### Continuous Internal Evaluation Pattern:

Attendance : 10 marks

Continuous Assessment Test (2 numbers) : 25 marks

Assignment/Quiz/Course project : 15 marks

**Assignments:** Assignment should include specific problems highlighting the applications of the methods introduced in this course in science and engineering.

**End Semester Examination Pattern:** There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

### Course Level Assessment Questions

**Course Outcome 1 (CO1):** Solve systems of linear equations, diagonalize matrices and characterise quadratic forms

1. A is a real matrix of order  $3 \times 3$  and  $X = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$ . What can you say about the solution of  $AX =$

0 if rank of A is 1? 2? 3?

2. Given  $A = \begin{bmatrix} 3 & 0 & 2 \\ 0 & 2 & 0 \\ -2 & 0 & 0 \end{bmatrix}$ , find an orthogonal matrix  $P$  that diagonalizes  $A$ .

3. Find out what type of conic section the following quadratic form represents

$$17x^2 - 30x_1x_2 + 17x_2^2 = 128$$

4. The matrix  $A = \begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$  has an eigen value 5 with corresponding Eigen vector  $X =$

$$\begin{bmatrix} 1 \\ 2 \\ -1 \end{bmatrix}. \text{ Find } A^5 X$$

**Course Outcome 2 (CO2):** compute the partial and total derivatives and maxima and minima of multivariable functions

1. Find the slope of the surface  $z = x^2y + 5y^3$  in the x-direction at the point (1,-2)

- Given the function  $w = xy + z$ , use chain rule to find the instantaneous rate of change of  $w$  at each point along the curve  $x = \cos t, y = \sin t, z = t$
- Determine the dimension of rectangular box open at the top, having a volume 32 cubic ft and requiring the least amount of material for its construction.

**Course Outcome 3(CO3):** compute multiple integrals and apply them to find areas and volumes of geometrical shapes, mass and centre of gravity of plane laminas.

- Evaluate  $\iint_D (x + 2y) dA$  where  $D$  is the region bounded by the parabolas  $y = 2x^2$  and  $y = 1 + x^2$
- Explain how you would find the volume under the surface  $z = f(x, y)$  and over a specific region  $D$  in the  $xy$  plane using (i) double integral (ii) triple integral?
- Find the mass and centre of gravity of a triangular lamina with vertices  $(0,0), (2,1), (0,3)$  if the density function is  $f(x, y) = x + y$
- Use spherical coordinates to evaluate  $\iiint_B (x^2 + y^2 + z^2)^3 dV$  where  $B$  is the unit ball defined by  $B = \{(x, y, z): x^2 + y^2 + z^2 \leq 1\}$

**Course Outcome 4 (CO4):** perform various tests to determine whether a given series is convergent, absolutely convergent or conditionally convergent.

- What is the difference between a sequence and a series and when do you say that they are convergent? Divergent?
- Determine whether the series  $\sum_{n=1}^{\infty} \frac{5}{2n^2 + 4n + 3}$  converges or diverges.
- Is the series  $\sum_{n=1}^{\infty} \frac{(-1)^{n-1}}{n}$  convergent? Absolutely convergent? Conditionally convergent?

**Course Outcome 5 (CO5):** determine the Taylor and Fourier series expansion of functions and learn their applications.

- Assuming the possibility of expansion find the Maclaurin series expansion of  $f(x) = (1 + x)^k$  for  $|x| < 1$  where  $k$  is any real number. What happens if  $k$  is a positive integer?
- Use Maclaurin series of  $\ln(1 + x), -1 < x \leq 1$  to find an approximate value of  $\ln 2$ .
- Find the Fourier series of the function  $f(x) = x^2, -2 \leq x < 2, f(x + 4) = f(x)$ . Hence using Parseval's identity prove that  $1 + \frac{1}{2^4} + \frac{1}{3^4} + \dots = \frac{\pi^4}{90}$
- Expand the function  $f(x) = x$  ( $0 < x < 1/2$ ) into a (i) Fourier sine series (ii) Fourier cosine series.

Model Question paper

QP CODE:

PAGES:3

Reg No: \_\_\_\_\_

Name : \_\_\_\_\_

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION,  
MONTH & YEAR

Course Code: MAT 101

Max. Marks: 100

Duration: 3 Hours

LINEAR ALGEBRA AND CALCULUS

(2019-Scheme)

(Common to all branches)

PART A

(Answer all questions, each question carries 3 marks)

1. Determine the rank of the matrix  $A = \begin{bmatrix} 1 & 2 & -1 \\ -2 & -4 & 2 \\ 3 & 6 & -3 \end{bmatrix}$ .
2. Write down the eigen values of  $A = \begin{bmatrix} 2 & 0 \\ 0 & -1 \end{bmatrix}$ . What are the eigen values of  $P^{-1}AP$  where  $P = \begin{bmatrix} -4 & 2 \\ 3 & -1 \end{bmatrix}$ ?
3. Find  $f_x(1,3)$  and  $f_y(1,3)$  for the function  $f(x,y) = 2x^3y^2 + 2y + 4x$ .
4. Show that the function  $u(x,t) = \sin(x - ct)$  is a solution of the equation  $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$ .
5. Use double integral to find the area of the region enclosed between the parabolas  $y = \frac{1}{2}x^2$  and the line  $y = 2x$ .
6. Use polar coordinates to evaluate the area of the region bounded by  $x^2 + y^2 = 4$ , the line  $y = x$  and the y axis in the first quadrant.
7. Test the convergence of the series  $\sum_{k=1}^{\infty} \frac{k}{k+1}$ .
8. Test the convergence of the alternating series  $\sum_{k=1}^{\infty} (-1)^{k+1} \frac{1}{k}$  using Leibnitz test.
9. Find the Taylor series expansion of  $\sin \pi x$  about  $x = \frac{1}{2}$ .
10. Find the values to which the Fourier series of

$f(x) = x$  for  $-\pi < x < \pi$ , with  $f(x + 2\pi) = f(x)$  converges

(10x3=30)

## PART B

(Answer **one full** question from each module, each question carries **14** marks)

### Module - I

11. (a) Solve the following system of equations

$$y + z - 2w = 0$$

$$2x - 3y - 3z + 6w = 2$$

$$4x + y + z - 2w = 4$$

- (b) Find the eigen values and eigen vectors of the matrix  $\begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$

12. (a) Diagonalize the matrix  $\begin{bmatrix} -1 & 2 & -2 \\ 2 & 4 & 1 \\ 2 & 1 & 4 \end{bmatrix}$

- (b) What kind of conic section the quadratic form  $3x_1^2 + 22x_1x_2 + 3x_2^2 = 0$  represents? Transform it to principal axes.

### Module - II

13. (a) Find the local linear approximation to  $f(x, y) = \sqrt{x^2 + y^2}$  at the point  $(3, 4)$ . Use it to approximate  $f(3.04, 3.98)$

- (b) Let  $w = \sqrt{x^2 + y^2 + z^2}$ ,  $x = \cos\theta$ ,  $y = \sin\theta$ ,  $z = \tan\theta$ . Use chain rule to find  $\frac{dw}{d\theta}$  when  $\theta = \frac{\pi}{4}$ .

14. (a) Let  $z = f(x, y)$  where  $x = r\cos\theta$ ,  $y = r\sin\theta$ , prove that

$$\left(\frac{\partial z}{\partial x}\right)^2 + \left(\frac{\partial z}{\partial y}\right)^2 = \left(\frac{\partial z}{\partial r}\right)^2 + \frac{1}{r^2} \left(\frac{\partial z}{\partial \theta}\right)^2.$$

- (b) Locate all relative maxima, relative minima and saddle points

$$f(x, y) = xy + \frac{a^3}{x} + \frac{b^3}{y} \quad (a \neq 0, b \neq 0).$$

### Module - III

15. (a) Evaluate  $\iint_D (2x^2y + 9y^3) dx dy$  where D is the region bounded by  $y = \frac{2}{3}x$  and  $y = 2\sqrt{x}$

- (b) Evaluate  $\int_0^4 \int_{\sqrt{y}}^2 e^{x^3} dx dy$  changing the order of integration.

16. (a) Find the volume of the solid bounded by the cylinder  $x^2 + y^2 = 4$  and the planes  $y + z = 4$  and  $z = 0$ .

- (b) Evaluate  $\iiint \sqrt{1 - x^2 - y^2 - z^2} dx dy dz$ , taken throughout the volume of the sphere  $x^2 + y^2 + z^2 = 1$ , by transforming to spherical polar coordinates

### Module - IV

17. (a) Test the convergence of the series

(i)  $\sum_{k=1}^{\infty} \frac{k^k}{k!}$       (ii)  $\sum_{k=2}^{\infty} \left(\frac{4k-5}{2k+1}\right)^k$

- (b) Determine the convergence or divergence of the series  $\sum_{k=1}^{\infty} (-1)^k \frac{(2k-1)!}{3^k}$

18. (a) Check whether the series  $\sum_{k=1}^{\infty} (-1)^{k+1} \frac{(2k)!}{(3k-2)!}$  is absolutely convergent, conditionally convergent or divergent.

(b) Test the convergence of the series  $1 + \frac{1.2}{1.3} + \frac{1.2.3}{1.3.5} + \frac{1.2.3.4}{1.3.5.7} + \dots$

### Module - V

19. (a) Obtain the Fourier series of for  $f(x) = e^{-x}$ , in the interval  $0 < x < 2\pi$ . with  $f(x + 2\pi) = f(x)$ . Hence deduce the value of  $\sum_{n=2}^{\infty} \frac{(-1)^n}{1+n^2}$ .

(b) Find the half range sine series of  $f(x) = \begin{cases} \frac{2kL}{x} & \text{if } 0 < x < \frac{L}{2} \\ \frac{2k(L-x)}{L} & \text{if } \frac{L}{2} < x < L \end{cases}$

20. (a) Expand  $(1+x)^{-2}$ . as a Taylor series about  $x = 0$  and state the region of convergence of the series.

(b) Find the Fourier series for  $f(x) = x^2$  in the interval  $-\pi < x < \pi$

with  $f(x + 2\pi) = f(x)$ . Hence show that  $\frac{1}{1^4} + \frac{1}{2^4} + \frac{1}{3^4} + \dots = \frac{\pi^4}{90}$ . (14X5=70)

### Syllabus

#### Module 1 (Linear algebra)

(Text 2: Relevant topics from sections 7.3, 7.4, 7.5, 8.1, 8.3, 8.4)

Systems of linear equations, Solution by Gauss elimination, row echelon form and rank of a matrix, fundamental theorem for linear systems (homogeneous and non-homogeneous, without proof), Eigen values and eigen vectors. Diagonalization of matrices, orthogonal transformation, quadratic forms and their canonical forms.

#### Module 2 (multivariable calculus-Differentiation)

(Text 1: Relevant topics from sections 13.3, 13.4, 13.5, 13.8)

Concept of limit and continuity of functions of two variables, partial derivatives, Differentials, Local Linear approximations, chain rule, total derivative, Relative maxima and minima, Absolute maxima and minima on closed and bounded set.

#### Module 3 (multivariable calculus-Integration)

(Text 1: Relevant topics from sections 14.1, 14.2, 14.3, 14.5, 14.6, 14.8)

Double integrals (Cartesian), reversing the order of integration, Change of coordinates (Cartesian to polar), finding areas and volume using double integrals, mass and centre of gravity of inhomogeneous laminas using double integral. Triple integrals, volume calculated as triple integral, triple integral in cylindrical and spherical coordinates (computations involving spheres, cylinders).



## Module 4 (sequences and series)

(Text 1: Relevant topics from sections 9.1, 9.3, 9.4, 9.5, 9.6)

Convergence of sequences and series, convergence of geometric series and p-series(without proof), test of convergence (comparison, ratio and root tests without proof); Alternating series and Leibnitz test, absolute and conditional convergence.

## Module 5 (Series representation of functions)

(Text 1: Relevant topics from sections 9.8, 9.9. Text 2: Relevant topics from sections 11.1, 11.2, 11.6 )

Taylor series (without proof, assuming the possibility of power series expansion in appropriate domains), Binomial series and series representation of exponential, trigonometric, logarithmic functions (without proofs of convergence); Fourier series, Euler formulas, Convergence of Fourier series (without proof), half range sine and cosine series, Parseval's theorem (without proof).

### Text Books

1. H. Anton, I. Biven, S. Davis, "Calculus", Wiley, 10<sup>th</sup> edition, 2015.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10<sup>th</sup> Edition, John Wiley & Sons, 2016.

### Reference Books

1. J. Stewart, Essential Calculus, Cengage, 2<sup>nd</sup> edition, 2017
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9<sup>th</sup> Edition, Pearson, Reprint, 2002.
3. Peter V. O'Neil, Advanced Engineering Mathematics, Cengage, 7<sup>th</sup> Edition, 2012
4. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
5. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36 Edition, 2010.

### Course Contents and Lecture Schedule

No	Topic	No. of Lectures
<b>1</b>	<b>Linear Algebra (10 hours)</b>	
1.1	Systems of linear equations, Solution by Gauss elimination	1
1.2	Row echelon form, finding rank from row echelon form, fundamental theorem for linear systems	3
1.3	Eigen values and eigen vectors	2
1.4	Diagonalization of matrices, orthogonal transformation, quadratic forms	4

	and their canonical forms.	
<b>2</b>	<b>Multivariable calculus-Differentiation (8 hours)</b>	
2.1	Concept of limit and continuity of functions of two variables, partial derivatives	2
2.2	Differentials, Local Linear approximations	2
2.3	Chain rule, total derivative	2
2.4	Maxima and minima	2
<b>3</b>	<b>Multivariable calculus-Integration (10 hours)</b>	
3.1	Double integrals (Cartesian)-evaluation	2
3.2	Change of order of integration in double integrals, change of coordinates (Cartesian to polar),	2
3.3	Finding areas and volumes, mass and centre of gravity of plane laminas	3
3.4	Triple integrals	3
<b>4</b>	<b>Sequences and series (8 hours)</b>	
4.1	Convergence of sequences and series, geometric and p-series	2
4.2	Test of convergence( comparison, ratio and root )	4
4.3	Alternating series and Leibnitz test, absolute and conditional convergence	2
<b>5</b>	<b>Series representation of functions (9 hours)</b>	
5.1	Taylor series, Binomial series and series representation of exponential, trigonometric, logarithmic functions;	3
5.2	Fourier series, Euler formulas, Convergence of Fourier series(Dirichlet's conditions)	3
5.3	Half range sine and cosine series, Parseval's theorem.	3

<b>HUN 102</b>	<b>PROFESSIONAL COMMUNICATION</b>	<b>CATEGORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>CREDIT</b>
		MNC	2	0	2	--

**Preamble:** Clear, precise, and effective communication has become a *sine qua non* in today's information-driven world given its interdependencies and seamless connectivity. Any aspiring professional cannot but master the key elements of such communication. The objective of this course is to equip students with the necessary skills to listen, read, write, and speak so as to comprehend and successfully convey any idea, technical or otherwise, as well as give them the necessary polish to become persuasive communicators.

**Prerequisite:** None

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

<b>CO 1</b>	Develop vocabulary and language skills relevant to engineering as a profession
<b>CO 2</b>	Analyze, interpret and effectively summarize a variety of textual content
<b>CO 3</b>	Create effective technical presentations
<b>CO 4</b>	Discuss a given technical/non-technical topic in a group setting and arrive at generalizations/consensus
<b>CO 5</b>	Identify drawbacks in listening patterns and apply listening techniques for specific needs
<b>CO 6</b>	Create professional and technical documents that are clear and adhering to all the necessary conventions

**Mapping of course outcomes with program outcomes**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
<b>CO 1</b>										3		2
<b>CO 2</b>										1		3
<b>CO 3</b>						1			1	3		
<b>CO 4</b>										3		1
<b>CO 5</b>		1							2	3		
<b>CO 6</b>	1					1			1	3		

**Mark distribution**

Total Marks	CIE	ESE	ESE Duration
100	50	50	2 hours

## Continuous Internal Evaluation

### Total Marks: 50

Attendance	: 10 marks
Regular assessment	: 25 marks
Series test (one test only, should include verbal aptitude for placement and higher studies, this test will be conducted for 50 marks and reduced to 15)	: 15 marks

### Regular assessment

Project report presentation and Technical presentation through PPT	: 7.5 marks
Listening Test	: 5 marks
Group discussion/mock job interview	: 7.5 marks
Resume submission	: 5 marks

## End Semester Examination

Total Marks: 50, Time: 2 hrs.

### Course Level Assessment Questions

#### Course Outcome 1 (CO1):

1. List down the ways in which gestures affect verbal communication.
2. Match the words and meanings  
Ambiguous      promotion  
Bona fide      referring to whole  
Holistic      not clear  
Exaltation      genuine
3. Expand the following Compound Nouns - a. Water supply. b. Object recognition. c. Steam turbine

#### Course Outcome 2 (CO2)

1. Read the passage below and prepare notes:

*Mathematics, rightly viewed, possesses not only truth, but supreme beauty—a beauty cold and austere, like that of sculpture, without appeal to any part of our weaker nature, without the gorgeous trappings of painting or music, yet sublimely pure, and capable of a stern perfection such as only the greatest art can show. The true spirit of delight, the exaltation, the sense of being more than man, which is the touchstone of the highest excellence, is to be found in mathematics as surely as in poetry. What is best in mathematics deserves not merely to be learnt as a task, but to be assimilated as a part of daily thought, and brought again and again before the mind with ever-renewed encouragement. Real life is, to most men, a long second-best, a perpetual compromise between the ideal and the possible; but the world of pure reason knows no compromise, no practical limitations, no barrier to the creative activity embodying in splendid edifices the passionate aspiration after the perfect from which all great work springs. Remote from human passions, remote even from the pitiful facts of nature, the generations have gradually created an ordered cosmos, where pure thought can dwell as in its natural home, and where one, at least, of our nobler impulses can escape from the dreary exile of the actual world.*

*So little, however, have mathematicians aimed at beauty, that hardly anything in their work has had this conscious purpose. Much, owing to irrepressible instincts, which were better than avowed*

*beliefs, has been moulded by an unconscious taste; but much also has been spoilt by false notions of what was fitting. The characteristic excellence of mathematics is only to be found where the reasoning is rigidly logical: the rules of logic are to mathematics what those of structure are to architecture. In the most beautiful work, a chain of argument is presented in which every link is important on its own account, in which there is an air of ease and lucidity throughout, and the premises achieve more than would have been thought possible, by means which appear natural and inevitable. Literature embodies what is general in particular circumstances whose universal significance shines through their individual dress; but mathematics endeavours to present whatever is most general in its purity, without any irrelevant trappings.*

*How should the teaching of mathematics be conducted so as to communicate to the learner as much as possible of this high ideal? Here experience must, in a great measure, be our guide; but some maxims may result from our consideration of the ultimate purpose to be achieved.*

- From "On the teaching of mathematics" – Bertrand Russell

2. Enumerate the advantages and disadvantages of speed reading. Discuss how it can impact comprehension.

**Course Outcome 3(CO3):**

1. What are the key elements of a successful presentation?
2. Elucidate the importance of non-verbal communication in making a presentation
3. List out the key components in a technical presentation.

**Course Outcome 4 (CO4):**

1. Discuss: 'In today's world, being a good listener is more important than being a good Speaker.'
2. Listen to a video/live group discussion on a particular topic, and prepare a brief summary of the proceedings.
3. List the do's and don'ts in a group discussion.

**Course Outcome 5 (CO5):**

1. Watch a movie clip and write the subtitles for the dialogue.
2. What do you mean by barriers to effective listening? List ways to overcome each of these.
3. What are the different types of interviews? How are listening skills particularly important in Skype/telephonic interviews?

**Course Outcome 6 (CO6):**

1. Explain the basic structure of a technical report.
2. You have been offered an internship in a much sought-after aerospace company and are very excited about it. However, the dates clash with your series tests. Write a letter to the Manager – University Relations of the company asking them if they can change the dates to coincide with your vacation.
3. You work in a well-reputed aerospace company as Manager – University Relations. You are in charge of offering internships. A student has sent you a letter requesting you to change the dates allotted to him since he has series exams at that time. But there are no vacancies available during the period he has requested for. Compose an e-mail informing him of this and suggest that he try to arrange the matter with his college.

## **Syllabus**

### **Module 1**

Use of language in communication: Significance of technical communication Vocabulary Development: technical vocabulary, vocabulary used in formal letters/emails and reports, sequence words, misspelled words, compound words, finding suitable synonyms, paraphrasing, verbal analogies. Language Development: subject-verb agreement, personal passive voice, numerical adjectives, embedded sentences, clauses, conditionals, reported speech, active/passive voice.

Technology-based communication: Effective email messages, slide presentations, editing skills using software. Modern day research and study skills: search engines, repositories, forums such as Git Hub, Stack Exchange, OSS communities (MOOC, SWAYAM, NPTEL), and Quora; Plagiarism

### **Module 2**

Reading, Comprehension, and Summarizing: Reading styles, speed, valuation, critical reading, reading and comprehending shorter and longer technical articles from journals, newspapers, identifying the various transitions in a text, SQ3R method, PQRS method, speed reading. Comprehension: techniques, understanding textbooks, marking and underlining, Note-taking: recognizing non-verbal cues.

### **Module 3**

Oral Presentation: Voice modulation, tone, describing a process, Presentation Skills: Oral presentation and public speaking skills, business presentations, Preparation: organizing the material, self-Introduction, introducing the topic, answering questions, individual presentation practice, presenting visuals effectively.

Debate and Group Discussions: introduction to Group Discussion (GD), differences between GD and debate; participating GD, understanding GD, brainstorming the topic, questioning and clarifying, GD strategies, activities to improve GD skills

### **Module 4**

Listening and Interview Skills Listening: Active and Passive listening, listening: for general content, to fill up information, intensive listening, for specific information, to answer, and to understand. Developing effective listening skills, barriers to effective listening, listening to longer technical talks, listening to classroom lectures, talks on engineering /technology, listening to documentaries and making notes, TED talks.

Interview Skills: types of interviews, successful interviews, interview etiquette, dress code, body language, telephone/online (skype) interviews, one-to-one interview & panel interview, FAQs related to job interviews

## Module 5

Formal writing: Technical Writing: differences between technical and literary style. Letter Writing (formal, informal and semi formal), Job applications, Minute preparation, CV preparation (differences between Bio-Data, CV and Resume), and Reports. Elements of style, Common Errors in Writing: describing a process, use of sequence words, Statements of Purpose, Instructions, Checklists.

Analytical and issue-based Essays and Report Writing: basics of report writing; Referencing Style (IEEE Format), structure of a report; types of reports, references, bibliography.

### Lab Activities

**Written:** Letter writing, CV writing, Attending a meeting and Minute Preparation, Vocabulary Building

**Spoken:** Phonetics, MMFS (Multimedia Feedback System), Mirroring, Elevator Pitch, telephone etiquette, qualities of a good presentation with emphasis on body language and use of visual aids.

**Listening:** Exercises based on audio materials like radio and podcasts. Listening to Song. practice and exercises.

**Reading:** Speed Reading, Reading with the help of Audio Visual Aids, Reading Comprehension Skills

**Mock interview and Debate/Group Discussion:** concepts, types, Do's and don'ts- intensive practice

### Reference Books

1. English for Engineers and Technologists (Combined edition, Vol. 1 and 2), Orient Blackswan 2010.
2. Meenakshi Raman and Sangeetha Sharma, "Technical Communication: Principles and Practice", 2nd Edition, Oxford University Press, 2011
3. Stephen E. Lucas, "The Art of Public Speaking", 10<sup>th</sup> Edition; McGraw Hill Education, 2012.
4. Ashraf Rizvi, "Effective Technical Communication", 2<sup>nd</sup> Edition, McGraw Hill Education, 2017.
5. William Strunk Jr. & E.B. White, "The Elements of Style", 4<sup>th</sup> Edition, Pearson, 1999.
6. David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. New York, 2004.
7. Goodheart-Willcox, "Professional Communication", First Edition , 2017.
8. Training in Interpersonal Skills: Tips for Managing People at Work, Pearson Education, India, 6 edition, 2015.
9. The Ace of Soft Skills: Attitude, Communication and Etiquette for Success, Pearson Education; 1 edition, 2013.
10. Anand Ganguly, "Success in Interview", RPH, 5th Edition, 2016.
11. Raman Sharma, "Technical Communications", Oxford Publication, London, 2004.