K S INSTITUTE OF TECHNOLOGY BANGALORE

MECHANICAL ENGINEERING DEPARTMENT

COURSE FILE

NAME OF THE STAFF : N.SREESUDHA

SUBJECT CODE/NAME : 17ME32/METERIAL SCIENCE

SEMESTER/YEAR : III/II

ACADEMIC YEAR : 2018-19

BRANCH : MECHANICAL ENGINEERING

COURSE INCHARGE

HOD

CHIEF ACADEMIC COORDINATOR

PRINCIPAL

K. S. INSTITUTE OF TECHNOLOGY

VISION

"To impart quality technical education with ethical values, employable skills and research to achieve excellence"

MISSION

- To attract and retain highly qualified, experienced & committed faculty.
- To create relevant infrastructure
- Network with industry & premier institutions to encourage emergence of new ideas by providing research & development facilities to strive for academic excellence
- To inculcate the professional & ethical values among young students with employable skills & knowledge acquired to transform the society

DEPARTMENT OF MECHANICAL ENGINEERING

VISION

"To groom incumbents to compete with their professional peers in mechanical engineering that brings recognition"

MISSION

- To impart sound fundamentals in mechanical engineering
- To expose students to new frontiers
- To achieve engineering excellence through experiential learning and team work.

PROGRAM EDUCATIONAL OBJECTIVES (PEO'S)

- To produce graduates who would have developed a strong background in basic science and mathematics and ability to use these tools in Mechanical Engineering.
- To prepare graduates who have the ability to demonstrate technical competence in their fields of Mechanical Engineering and develop solutions to the problems.
- To equip graduates to function effectively in a multi-disciplinary environment individually, within a global, societal, and environmental context.
- To create a sense of responsibility to promote of a team towards the fulfillment of both individual and organizational goals.

PROGRAM SPECIFIC OUTCOMES (PSO's)

- It is expected that a student in mechanical engineering will possess an:
- **PSO1:** Ability to apply concept of mechanical engineering to design a system, a component or a process/system to address a real world challenges
- **PSO2:** Ability to develop effective communication, team work, entrepreneurial and computational skills

K. S. INSTITUTE OF TECHNOLOGY

#14, Raghuvanahalli, Kanakapura Main Road, Bengaluru-5600109

DEPARTMENT OF MECHANICAL ENGINEERING

Course: Material Science			
Type: Core		Course Code:17ME32	
No of Hours per week			
Theory (Lecture Class)	Practical/Field Work/Allied Activities	Total/Week	Total teaching hours
4	0	4	50
Marks			
Internal Assessment	Examination	Total	Credits
40	60	100	4

Aim/Objective of the Course:

1. The foundation for understanding the structure and various modes of failure in materials commonly used in mechanical engineering.
2. Topics are designed to explore the mechanical properties of metals and their alloys, polymers, ceramics, smart materials and composites.
3. The means of modifying such properties, as well as the processing and failure of materials.
4. Concepts of use of materials for various applications are highlighted.

Course Learning Outcomes:

After completing the course, the students will be able to,

CO1	**Interpret** the basic concepts of crystal structure, concepts of diffusion, mechanical behavior of materials and various modes of failure.	Understand(K2)
CO2	**Classify** solid solutions, interpret equilibrium phase diagrams of ferrous and nonferrous alloys and mechanism of solidification.	Understand(K2)
CO3	**Relate** suitable heat-treatment process to achieve desired properties of metals and alloys	Understand(K2)
CO4	**Interpret** the properties and applications of various materials like ceramics, plastics and Smart materials.	Understand(K2)
CO5	**Identify** various composite materials and their processing as well as applications.	Apply (K3)

Syllabus Content:	
Module 1: **Basics, Mechanical Behavior, Failure of Materials** Introduction to Crystal Structure – Coordination number, atomic packing factor, Simple Cubic, BCC, FCC and HCP Structures, Crystal imperfections – point, line, surface and volume imperfections, Atomic Diffusion: Phenomenon, Fick's laws of diffusion; Factors affecting diffusion. **Mechanical Behavior**: Stress-strain diagrams showing ductile and brittle behavior of materials, Engineering and true strains, Linear and non-linear elastic behavior and properties, Mechanical properties in plastic range. Stiffness, Yield strength, Offset Yield strength, Ductility, Ultimate Tensile strength, Toughness, Plastic deformation of single crystal by slip and twinning, Mechanisms of strengthening in metals **Fracture:** Type I, Type II and Type III, **Fatigue:** Types of fatigue loading with examples, Mechanism of fatigue, Fatigue properties, S-N diagram, Fatigue testing. **Creep:** Description of the phenomenon with examples, three stages of creep, creep properties, Stress relaxation. Concept of fracture toughness. LO: At the end of this session the student will be able to, 1. **Understand the concept of crystal structure, diffusion and mechanical behaviour of materials.** 2. **Explain mechanical properties in elastic and plastic region** 3. **Identify the types of fractures**	CO1 10hrs PO1-3 PO2-1 PO3-1 PO4-1 PO5-1 PO12-1 PS01-3 PS02-1

Module – 2 **Solid solutions,** Substitutional and interstitial solid solutions and factors affecting solid solubility (Hume Rothery rules). Solidification: Mechanism of solidification, Homogenous and Heterogeneous nucleation, Crystal growth. Binary phase diagrams: Eutectic, and Eutectoid systems Lever rule,Intermediate phases, Gibbs phase rule Effect of nonequilibrium cooling, Coring and Homogenization Iron-Carbon (Cementite) diagram: description of phases, Specifications of steels., Numerical on lever rule. LO: At the end of this session the student will be able to, 1. **Explain solid solution and its types.** 2. **Understand the mechanism of solidification and interpretation of phase diagrams.** 3. **Identifying percentage of composition in various phases at specific temperature using lever rule.**	CO2 10hrs. PO1-3 P02-2 P012-1 PS01-3 PS02-1
Module 3 Time-Temperature-Transformation (TTT) curves, Continuous Cooling Transformation (CCT) curves, Annealing: Recovery,Recrystallization and Grain growth, Types of annealing, Normalizing, Hardening, Tempering, Martempering, Austempering, Concept of hardenability, Factors affecting it hardenability, surface hardening methods: carburizing, cyaniding, nitriding, flame hardening and induction hardening, Age hardening of aluminum-copper alloys and PH steels. Ferrous materials: Properties, Compositions and uses of Grey cast iron, Malleable iron, SG iron and steel. LO: At the end of this session the student will be able to, 1. **Understanding TTT and CCT curves.** 2. **Explain the importance of various heat treatment processes which influences the properties of a material.** 4. **Identify ferrous materials, their properties and applications**	CO3 10hrs PO1-3 PO2-2 PO12-1 PS01-3 PSO2-1
Module 4: **Other Materials, Material Selection** **Ceramics:** Structure types and properties and applications of ceramics. Mechanical / Electrical behavior and processing of Ceramics. **Plastics:** Various types of polymers/plastics and their applications. Mechanical behaviors and processing of plastics, Failure of plastics. **Other materials:** Smart materials and Shape Memory alloys, properties and	CO4 10hrs PO1-3 PO2-1 PO3-1

applications. LO: At the end of this session the student will be able to, 1. **Understand the importance of ceramic material, their structure and mechanical behaviour.** 2. **Identify various types of polymers/plastics and their applications. Mechanical behaviors and processing of plastics, Failure of plastics.** 3. **Demonstrate the importance of smart materials and shape memory alloys.**	PO12-1 PSO1-3 PSO2-1
Module 5: **Composite Materials** Composite materials - Definition, classification, types of matrix materials & reinforcements, Metal Matrix Composites (MMCs), Ceramic Matrix Composites (CMCs) and Polymer Matrix Composites (PMCs), Particulate-reinforced and fiber-reinforced composites, Fundamentals of production of composites, Processes for production of composites, Constitutive relations of composites, Numerical problems on determining properties of composites LO: At the end of this session the student will be able to, 1. **Explain the role ofcomposite materials todays catering.** 2. **Identify the processing techniques of composite materials**	CO5 10hrs PO1-3 PO2-1 PO3-2 PO9-1 PO12-1 PSO1-3 PSO2-2

Text Books: - (specify minimum two foreign authors text books)

1. William D. Callister, Material science and Engineering and Introduction, Wiley, 2006.

2. Smith, Foundations of Materials Science and Engineering, 4th Edition, McGraw Hill, 2009.

Reference Books:

1. V.Raghavan, Materials Science and Engineering, , PHI, 2002.
2. Donald R. Askland and Pradeep.P. Phule, The Science and Engineering of Materials, Engage Learning, 4lh Ed., 2003.
3. George Ellwood Dieter, Mechanical Metallurgy, McGraw-Hill.
4. ASM Handbooks, American Society of Metals.

Useful Websites

https://nptel.ac.in/courses/113106032/
https://nptel.ac.in/courses/112108150/
http://www.nptelvideos.com/applied_mechanics/material_science_video_lectures.php

Useful Journals

- Journal of Material Science
- Journal of Wear
- Journal of composite materials

Teaching and Learning Methods:

1. Lecture class: 50 hrs.
2. Self-study: 5hrs.
3. Field visits/Group Discussions/Seminars: 3hrs.
4. Practical classes: 3hrs.

Assessment:

Type of test/examination: Written examination

Continuous Internal Evaluation(CIE) : 20 marks (Average of best two of total three tests will be considered)

Semester End Exam(SEE) : 80 marks (students have to answer all main questions)

Test duration: 1 :30 hr

Examination duration: 3 hrs

CO to PO Mapping

PO1: Science and engineering Knowledge **PO2:** Problem Analysis **PO3:** Design & Development **PO4:**Investigations of Complex Problems **PO5:** Modern Tool Usage **PO6:** Engineer & Society	**PO7:**Environment and Society **PO8:**Ethics **PO9:**Individual & Team Work **PO10:** Communication **PO11:**Project Mngmt & Finance **PO12:**Life long Learning

PSO1: Ability to apply concept of mechanical engineering to design a system, a component or a process/system to address a real world challenges

PSO2: Ability to develop effective communication, team work, entrepreneurial and computational skills

CO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
15 ME53	K-level														
CO1	K2	3	1	1	-	2	1	-	-	-	-	-	1	3	1
CO2	K2	3	2	-	-	-	-	-	-	-	-	-	1	3	1
CO3	K2	3	2	-	-	-	-	-	-	-	-	-	1	3	1
CO4	K2	3	1	1	-	-	-	-	-	-	-	-	1	3	1
CO5	K3	3	1	2	-	-	-	-	-	1	-	-	1	3	2

Signature of Faculty

Signature of Module Coordinator

Signature of HOD

Signature of Chief Academic Coordinator

Signature of Principal

ACADEMIC CO-ORDINATOR
K.S. Institute of Technology
Bengaluru - 560 109.

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CALENDAR OF EVENTS: ODD SEMESTER (2018-2019)

SESSION: AUG 2018 – DEC 2018 (I SEMESTER)

Week No.	Month	Day						Days	Activities
		Mon	Tue	Wed	Thu	Fri	Sat		
1	Aug	13	14	15H	16	17	18	5	15 - Independence Day 13-18 Induction Programme
2	Aug	20	21	22H	23	[illegible]	25	4	22-Habrid 24 - Varamahalakshmi Vratham 25-Thursday time table
3	Aug/Sep	27	28	29	30	31	1	6	1-Friday time table
4	Sep	3	4	5	6	7	8DH	5	
5	Sep	10	11	12H	13H	14	15	4	12-Onam vratham 13-vinayaka chaturthi 15-Friday time table
6	Sep	17	18	19	20	21H	22DH	4	21-Moharam last day
7	Sep	24	25	26	27	28	29	6	29-Wednesday time table
8	Oct	1	2H	3	4	5	6	5	2-Gandhi Jayanthi 6-Thursday time table
9	Oct	8H	9	10	11	12	13	5	8-Mahalaya Amavasya 13-Friday time table
10	Oct	15	16	17	18H	19H	20DH	3	18-Maharnavami 19-Vijayadasami
11	Oct/ Nov	22	23TA	24H	25T1	26T1	27T1	5	24-valmiki Jayanthi
12	Oct/Nov	29	30	31	1H	2BV	3ASD	5	1-kannada rajyothava 3-Wednes day time table
13	Nov	5	6H	7DH	8H	9	10	3	6-naraka chaturdasi 7-Amavasya 8-Balipadyami 10-Thursday time table
14	Nov	12	13	14	15	16	17	6	17-Friday time table
15	Nov	19	20TA	21H	22T2	23T2	24T2	5	21-Id Milad
16	Nov	26H	27	28	29	30BV	1ASD	5	26-kanakadasa Jayanthi 1-Wednesday time table
17	Dec	3	4	5	6	7	8DH	5	
18	Dec	10	11	12	13	14	15	6	15-Thursday time table
19	Dec	17	18	19	20	21	22 DH	5	
20	Dec	24	25H	26	27	28	29	5	25- Christmas 29-Friday time tble
21	Dec/Jan	31	1	2TA	3T3	4T3	5T3	6	
22	Jan	7LT	8LT	9LT	10LT	11LT	12DH	5	
23	Jan	14H	15BV	16ASD	17			3	14-Makara Sankranthi
TOTAL NO. of Working Days: 111									

H	Holiday
BV	Blue Book Verification
T1,T2,T3	Tests 1,2,3
ASD	Attendance & Sessional Display
DH	Declared Holiday
LT	Lab Test
TA	Test attendance

Total Number of working days (Excluding holidays and Tests)

Monday	18
Tuesday	18
Wednesday	19
Thursday	18
Friday	19
Total	92

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BENGALURU - 560 109

MATERIAL SCIENCE

B.E, III Semester, Mechanical Engineering

[As per Choice Based Credit System (CBCS) scheme]

Course Code	**17ME32**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50(10 Hours per Module)**	**Exam Hours**	**03**
Credits – 04			

Course Objectives:

- **The foundation for understanding the structure and various modes of failure in materials common in mechanical engineering.**
- **Topics are designed to explore the mechanical properties of metals and their alloys, polymers, ceramics ,smart materials and composites.**
- **The means of modifying such properties, as well as the processing and failure of materials.**
- **Concepts of use of materials for various applications are highlighted.**

Module - 1

Basics, Mechanical Behavior, Failure of Materials

Introduction to Crystal Structure – Coordination number, atomic packing factor, Simple Cubic, BCC, FCC and HCP Structures, Crystal imperfections – point, line, surface and volume imperfections, Atomic Diffusion: Phenomenon, Fick's laws of diffusion; Factors affecting diffusion.

Mechanical Behavior:

Stress-strain diagrams showing ductile and brittle behavior of materials, Engineering and true strains, Linear and non-linear elastic behavior and properties, Mechanical properties in plastic range. Stiffness, Yield strength, Offset Yield strength, Ductility, Ultimate Tensile strength, Toughness, Plastic deformation of single crystal by slip and twinning, Mechanisms of strengthening in metals

Fracture: Type I, Type II and Type III,

Fatigue: Types of fatigue loading with examples, Mechanism of fatigue, Fatigue properties, S-N diagram, Fatigue testing. **Creep:** Description of the phenomenon with examples, three stages of creep, creep properties, Stress relaxation. Concept of fracture toughness.

Module - 2

Alloys, Steels, Solidification

Concept of formation of alloys: Types of alloys, solid solutions, factors affecting solid solubility (Hume Rothery rules), Binary phase diagrams: Eutectic, and Eutectoid systems, Lever rule, Substitutional and interstitial solid solutions, Intermediate phases, Gibbs phase rule Effect of non-equilibrium cooling, Coring and Homogenization Iron-Carbon (Cementite) diagram: description of phases, Specifications of steels. Solidification: Mechanism of solidification, Homogenous and Heterogeneous nucleation, Crystal growth, Numerical on lever rule

Module - 3

Heat Treatment, Ferrous and Non-Ferrous Alloys

Heat treating of metals: Time-Temperature-Transformation (TTT) curves, Continuous Cooling Transformation (CCT) curves, Annealing: Recovery, Recrystallization and Grain growth, Types of annealing, Normalizing, Hardening, Tempering, Martempering, Austempering, Concept of hardenability, Factors affecting it hardenability, surface hardening methods: carburizing, cyaniding, nitriding, flame hardening and induction hardening, Age hardening of aluminum-copper alloys and PH steels. Ferrous materials: Properties, Compositions and uses of Grey cast iron, Malleable iron, SG iron and steel,

Module - 4

Other Materials, Material Selection

Ceramics: Structure types and properties and applications of ceramics. Mechanical / Electrical behavior and processing of Ceramics.

Plastics: Various types of polymers/plastics and their applications. Mechanical behaviors and processing of plastics, Failure of plastics.

Other materials: Smart materials and Shape Memory alloys, properties and applications.

Module - 5

Composite Materials

Composite materials - Definition, classification, types of matrix materials & reinforcements, Metal Matrix Composites (MMCs), Ceramic Matrix Composites (CMCs) and Polymer Matrix Composites (PMCs), Particulate-reinforced and fiber-reinforced composites, Fundamentals of production of composites, Processes for production of composites, Constitutive relations of composites, Numerical problems on determining properties of composites.

Course outcomes:

- **Describe the mechanical properties of metals, their alloys and various modes of failure.**
- **Understand the microstructures of ferrous and non-ferrous materials to mechanical properties.**
- **Explain the processes of heat treatment of various alloys.**
- **Understand the properties and potentialities of various materials available and material selection procedures.**
- **Know about composite materials and their processing as well as applications.**

TEXT BOOKS:

1. Smith, Foundations of Materials Science and Engineering, 4th Edition, McGraw Hill, 2009.
2. William D. Callister, Material science and Engineering and Introduction, Wiley, 2006.

REFERENCE BOOKS

1. V.Raghavan, Materials Science and Engineering, , PHI, 2002
2. Donald R. Askland and Pradeep.P. Phule, The Science and Engineering of Materials, Cengage Learning, 4lh Ed., 2003.
3. George Ellwood Dieter, Mechanical Metallurgy, McGraw-Hill.
4. ASM Handbooks, American Society of Metals.

KSIT Bangalore

DEPARTMENT OF MECHANICAL ENGINEERING
ASSIGNMENT QUESTIONS

Academic Year	2018-2019		
Batch	2017-2021		
Year/Semester/section	I/III/A&B		
Subject Code-Title	17ME32-MATERIAL SCIENCE		
Name of the Instructor	Mr. BHARATH KUMAR K R & Mrs.N.SREESUDHA	Dept	ME

Assignment No: 1 **Total marks:15**
Date of Issue: 01.09.2018 **Date of Submission: 10.09.2018**

Sl.No	Assignment Questions	K Level	CO	Marks
1.	**Interpret** the APF for an ideally packed FCC & HCP unit cell.	K2 (Understand)	CO1	2
2.	**Classify** and **Explain** different types of crystal imperfections with neat sketches.	K2 (Understand)	CO1	2
3.	**Discuss** ductile and brittle behaviour of engineering materials by drawing neat stress-stain diagram.	K2 (Understand)	CO1	2
4.	**Define** Critically Resolved Shear Stress (CRSS) and **interpret** an expression for it.	K2 (Understand)	CO1	2
5.	**Explain** Type-I, Type-II and Type-III fracture.	K2 (Understand)	CO1	2
6.	**Explain** the factors affecting substitutional solid solubility.	K2 (Understand)	CO2	1
7.	**Name** the different types of phase diagrams and label all the fields in the phase diagrams of eutectic (complete and partial solubility) and eutectoid systems.	K1 (Remember)	CO2	1
8.	**Write a note** on Gibbs Phase Rule.	K2 (Understand)	CO2	1
9.	**Differentiate** homogeneous and heterogeneous nucleation.	K2 (Understand)	CO2	1
10.	**Discuss** the prediction of phases, composition and amount of phases for a solid solution using binary phase diagram.	K2 (Understand)	CO2	1

Course In charge

HOD/ME

Module Coordinator

Chief Academic Coordinator

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I ASSIGNMENT 2018 – 19 ODD SEMESTER

SCHEME AND SOLUTION

Degree : B.E
Branch : Mechanical
Course Title : Material Science

Semester : III
Course Code : 17ME32
Max Marks : 15

Q.NO.	POINTS	MARKS
1	Explanation of HCP crystal structure with neat figure. No.of atoms in one unit of HCP unit cell: 2+1+3= 6 atoms. We have a=2r C= 1.633a Find the volume of the hexagonal unit cell : Volume= $a^2\sqrt{3}/4 * 6 * 1.633a$ Atomic packing factor= $\frac{\text{no.of atoms*volume of each atom}}{\text{Volume of unit cell}}$ APF = $\frac{6 * 4\Pi r^3 * 4}{3\sqrt{3} * 6 * 1.633 * a^3}$ APF= 0.74	2
2	Classification of crystal imperfections: 1.Point imperfections 2.Line imperfections 3.Surface imperfections 4.Volume imperfections. Explain all the imperfections.	2
3	Explanation of stress-strain diagram of ductile materials by showing all salient points. Explanation of brittle materials with stress-strain diagram.	2
4	Critically resolved shear stress: Derivation of expression $\tau = \sigma/2$. With neat figure. The value of the maximum shear stress acting at an angle of 45° is equal to half of the applied tensile stress.	2

Q.NO.	POINTS	MARKS
5	Explanation of type I fracture or ductile fracture with fracture diagram. Type II fracture or Brittle fracture with fracture diagram Type III fracture or shear fracture with fracture diagram.	2
6	Explain Hume- Rothary rules Factors are : 1.Crystal structure 2.Atomic size 3. Chemical affinity 4. Electro negativity 5.Valence factor	1
7	Differences of Eutectic and Eutectoid reactions with neat binary phase diagrams.	1
8	Explanation of Gibbs phase rule: P+F=C+2 Explain each term.	
9	Write the differences between homogeneous & heterogeneous nucleation .Write expressions of critical radius. Draw required diagrams.	1
10	Explanation of binary phase diagram with a neat diagram. Explain no.of phases, amount of phase and composition in binary phase diagram.	1

Signature of Course incharge

Signature of Module Coordinator

Signature of Chief Academic Coordinator

Signature of Principal

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Bengaluru - 560 109.

HOD

KSIT

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DEPARTMENT OF MECHANICAL ENGINEERING

ASSIGNMENT QUESTIONS

Academic Year	2018-2019		
Batch	2017-2021		
Year/Semester/section	I/III/B		
Subject Code-Title	17ME32-MATERIAL SCIENCE		
Name of the Instructor	Mrs.N.Sreesudha	Dept	ME

Assignment No: 2 **Total marks:15**
Date of Issue: 10.10.2018 **Date of Submission: 22.10.2018**

Sl.No	Assignment Questions	K Level	CO	Marks
1.	**Illustrate** the Iron-Carbon (Fe-Fe3C) equilibrium diagram with a neat sketch.	K2 (Understanding)	CO2	1
2.	**Compare** homogenous nucleation with heterogeneous nucleation	K2 (Understanding)	CO2	1
3.	**Explain** the process of mechanism of solidification.	K2 (Understanding)	CO2	1
4.	**Discuss** the process of crystal growth with a neat diagram.	K2 (Understanding)	CO2	1
5.	**Outline** the causes for critical radius of a nucleus during homogenous nucleation with an expression.	K2 (Understanding)	CO2	1
6.	**Distinguish** between Austempering and Martempering.	K2 (Understanding)	CO3	2
7.	**Interpret** the process of flame hardening process with a neat sketch.	K2 (Understanding)	CO3	2
8.	With a neat sketch, **write a note** on carburizing methods.	K2 (Understanding)	CO3	2
9.	**Illustrate** the various steps involved in constructing TTT diagram.	K2 (Understanding)	CO3	2
10.	**Discuss** the process of hardenability by Jominy End-Quench test.	K2 (Understanding)	CO3	2

Course In charge

Module Coordinator

HOD/ME

Chief Academic Coordinator

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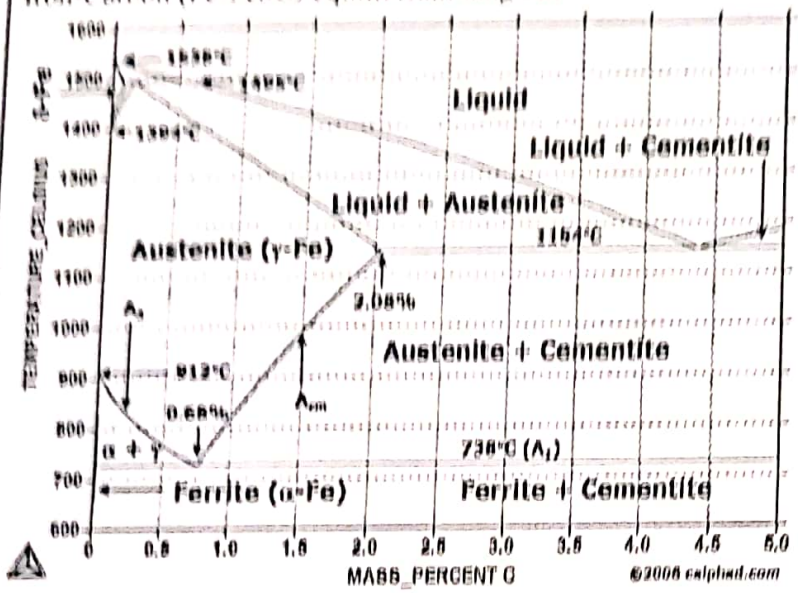
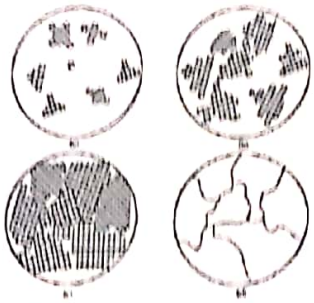
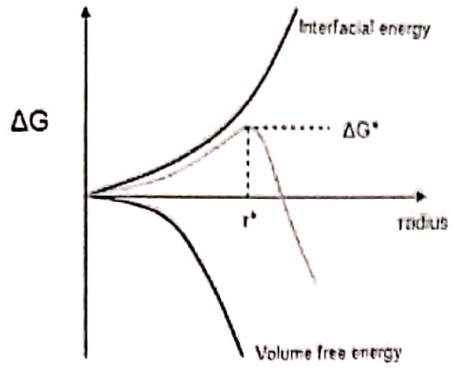
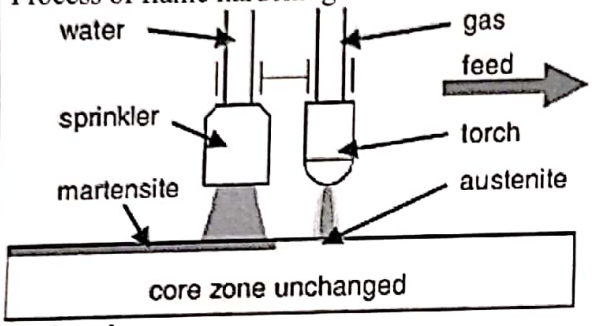
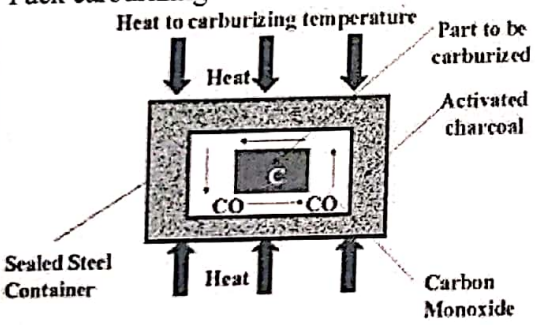
K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109
II ASSIGNMENT 2018 - 19 ODD SEMESTER

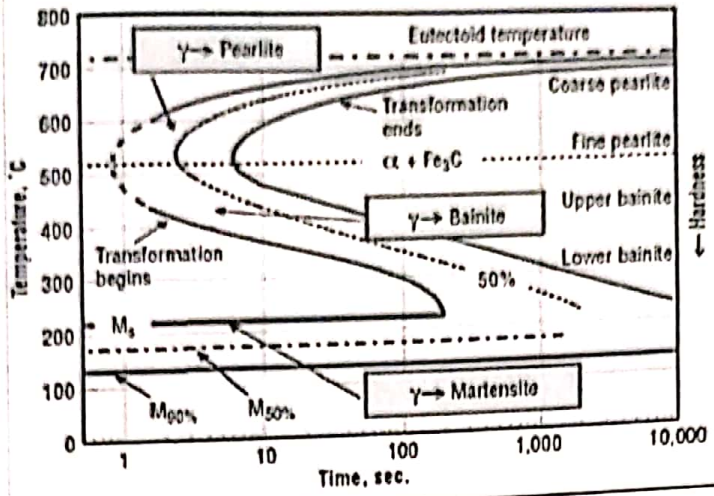
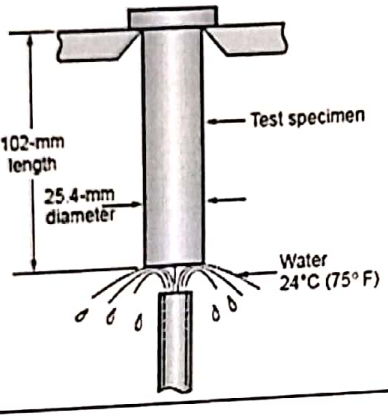
SCHEME AND SOLUTION

Degree : B.E
Branch : Mechanical Engineering
Course Title : Material Science

Semester : III
Course Code : 17ME32
Max Marks : 15

Q.NO.	POINTS	MARKS
1	Iron Carbon (Fe-Fe3C) equilibrium diagram  Explanation	1
2	Any five differences between homogenous nucleation with heterogeneous nucleation	1
3	Process of mechanism of solidification Explanation about formation of deadrites Explanation about crystal growth	1
4	Process of crystal growth  Explanation	1
5	Critical radius of a nucleus during homogenous nucleation	1

	 Derivation	
6	Any five differences between betweenAustempering and Martempering	2
7	Process of flame hardening  Explanation	2
8	Explanation on following Carburizing methods Pack carburizing  Gas carburizing Liquid carburizing	2
9	Various steps involved in constructing TTT diagram	2

	TTT DIAGRAM 	
10	Process of hardenability by Jominy End-Quench test 	2

Signature of Course incharge

Signature of Module Coordinator

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K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109
I SESSIONAL TEST QUESTION PAPER 2018 – 19 ODD SEMESTER

SET-A

USN | | | | | | | | | |

Degree : B.E
Branch : Mechanical Engineering
Course Title : Material Science
Duration : 90 Minutes

Semester : III
Course Code : 17ME32
Date : 14.09.2018
Max Marks : 30

Note: Answer ONE full question from each part.

Q No.	Question	Marks	CO mapping	K-Level
	PART-A			
1(a)	Classify the crystal defects and explain the point defect and line defect.	5	CO1	K2 (Understand)
(b)	Interpret the APF for an ideally packed HCP unit cell.	5	CO1	K2 (Understand)
(c)	Interpret the substitutional and interstitial solid solutions during the formation of alloys.	5	CO2	K2 (Understand)
	OR			
2(a)	Explain briefly the mechanical properties of a material in plastic range.	5	CO1	K2 (Understand)
(b)	Illustrate an expression for Critically Resolved–Shear Stress (CRSS).	5	CO1	K2 (Understand)
(c)	Sketch and explain the eutectic and eutectoid binary phase diagrams.	5	CO2	K2 (Understand)
	PART-B			
3(a)	Illustrate the different stages of creep with a creep curve.	5	CO1	K2 (Understand)
(b)	Summarize the different stages in ductile fracture with a neat sketch.	5	CO1	K2 (Understand)
(c)	Discuss the factors affecting solid solubility (Hume Rothery rules).	5	CO2	K2 (Understand)
	OR			
4(a)	Differentiate between slip and twinning in plastic deformation.	5	CO1	K2 (Understand)
(b)	Draw a neat sketch of S-N curve and explain RR Moore test for fatigue in materials.	5	CO1	K2 (Understand)
(c)	Explain the Gibbs Phase rule for solid solution.	5	CO2	K2 (Understand)

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Signature of Chief Academic Coordinator | Signature of Principal

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K.S. Institute of Technology
Bangalore-560 109

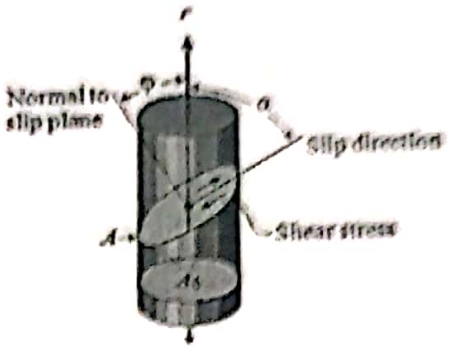
K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109
I SESSIONAL TEST QUESTION PAPER 2018 – 19 ODD SEMESTER

SCHEME AND SOLUTION

Degree : **B.E** **Semester : III**
Branch : **Mechanical Engineering** **Course Code : 17ME32**
Course Title : **Material Science** **Max Marks : 30**

Q.NO.	POINTS	MARKS
1 (a)	Crystal defects and explain the point defect and line defect Explanation of Point defects Sketches for Point defects Explanation of Line defects Sketches for Line defects	 2 M ½ M 2 M ½ M
1 (b)	APF for HCP structure For finding Volume of each atom $= \frac{4}{3}\pi r^3$. For finding $No.\ of atoms in unit cell = 6$ $h = \frac{a\sqrt{3}}{2}$ $Volume\ of\ hexagonal\ unit = \left(\frac{3a^2\sqrt{3}}{2}\right) X\ C$ $To express a in terms of r; a = 2r$ $For finding APF = 74\%$	 1M 1M 1M 1M 1M
1 (c)	Substitutional solid solutions during the formation of alloys Explanation Sketch interstitial solid solutions during the formation of alloys Explanation Sketch	 2 M ½ M 2 M ½ M
2 (a)	Mechanical properties of a material in plastic range Yield Strength Offset – yield strength	 1 M 1 M

	Ductility Ultimate Tensile Strength Toughness	1 M 1 M 1 M
2 (b)	Critically Resolved Shear Stress (CRSS)	



1 M

Resolved forces of the expression;

$$F_r = F\cos\alpha$$ 1 M

$$A_s = \frac{A}{\cos\emptyset}$$

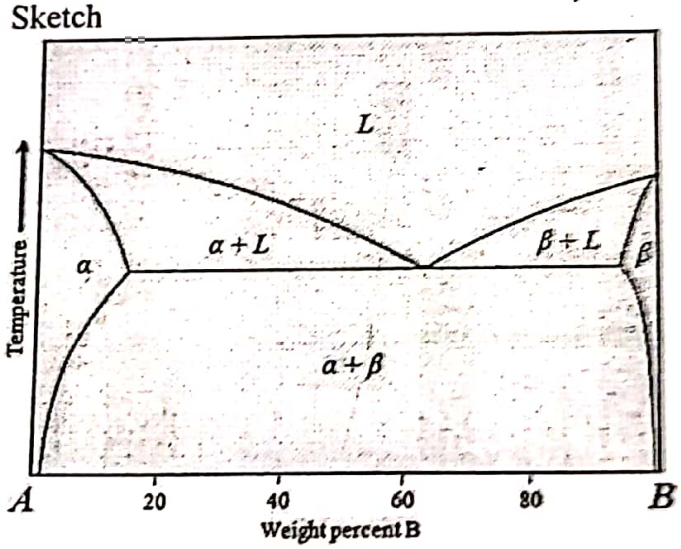
For finding the resolved shear stress

$$\tau_r = \sigma\cos\alpha\cos\varphi$$ 1 M

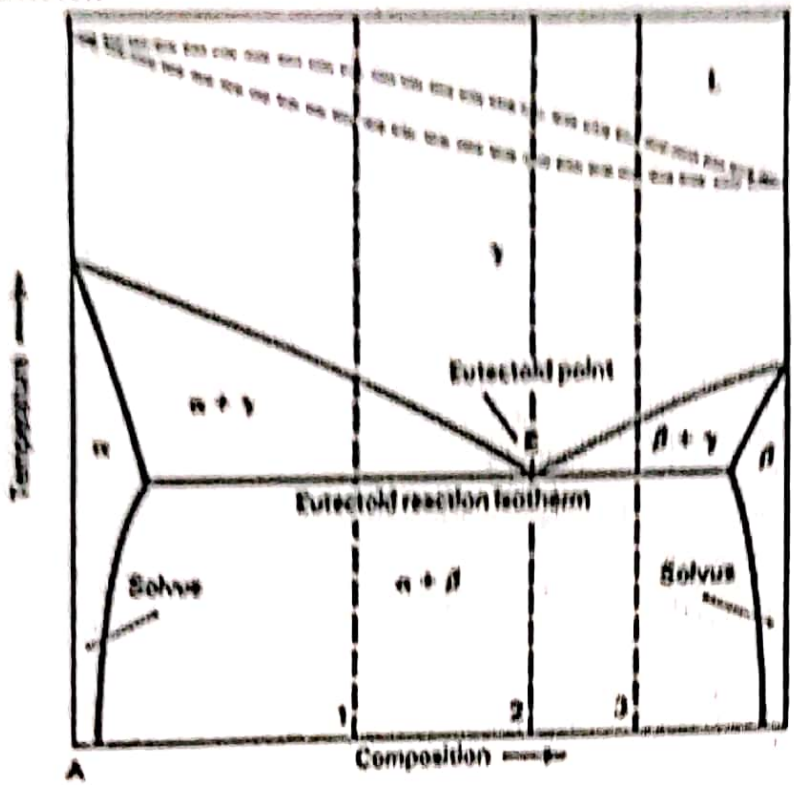
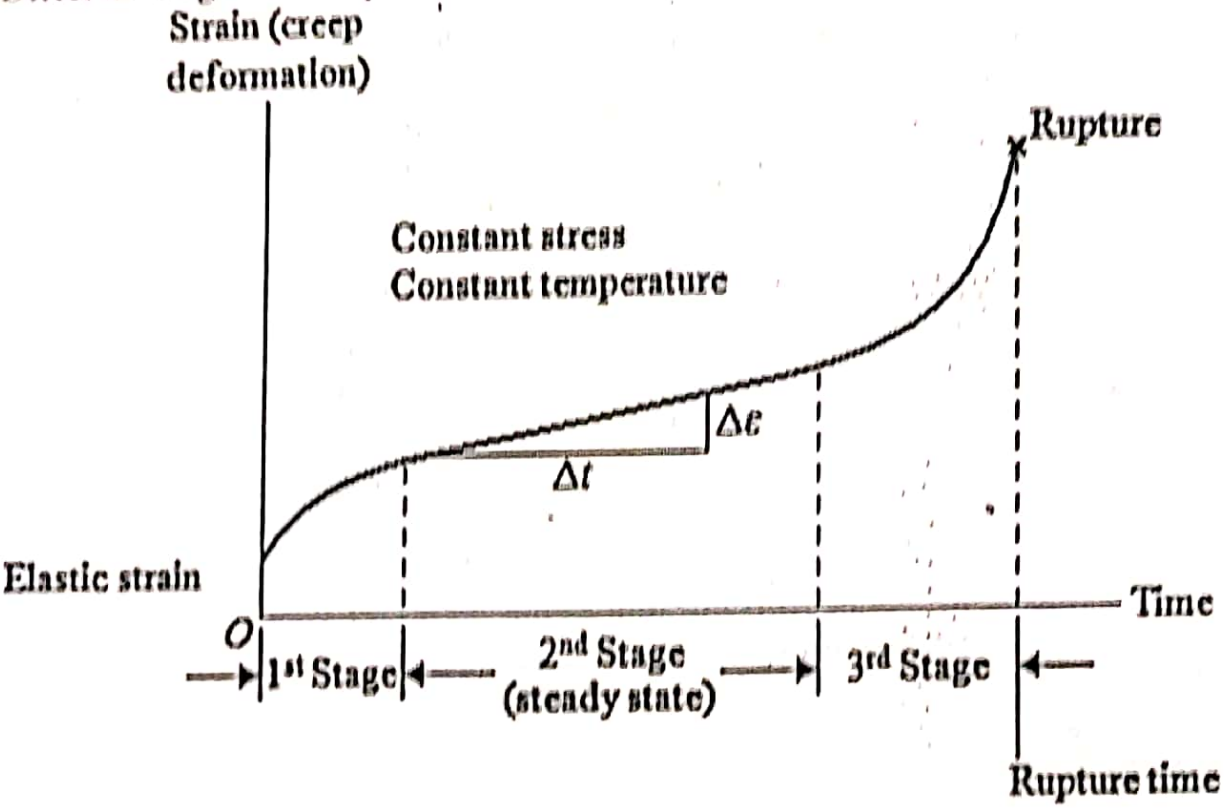
For justifying maximum values

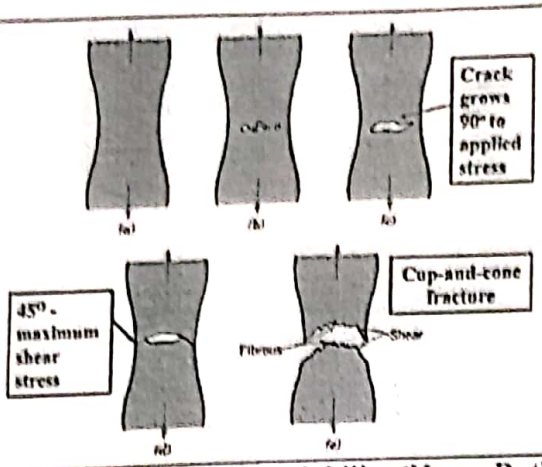
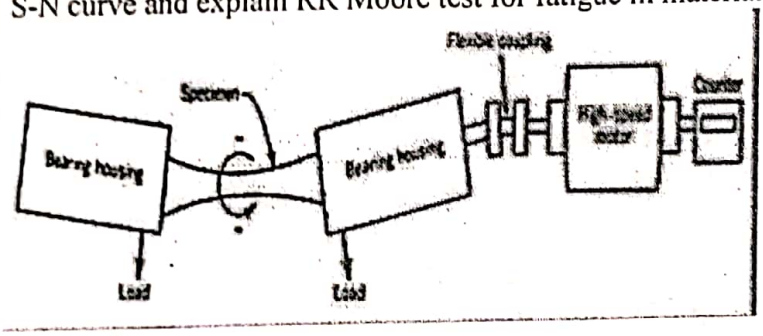
$$\tau_r = \frac{\sigma}{2}$$ 1 M

2 (c)	Eutectic binary phase diagram Sketch	1 M



Explanation 2M

	Eutectoid binary phase diagrams Sketch	1 M
		
	Explanation	1 M
3 (a)	Different stages of creep with a creep curve.	
		2 M
	Explanation on; Primary Stage Secondary Stage Tertiary Stage	1 M 1 M 1 M
3 (b)	Five stages in ductile fracture with a neat sketch Explanation	4 M

		1 M
3 (c)	Factors affecting solid solubility (Hume Rothery rules). Crystal structure Atomic Size Chemical Affinity Factor Electro-negativity Valence Factor	1 M 1 M 1 M 1 M 1 M 1 M
4 (a)	Any 5 differences between slip and twinning	5 M
4 (b)	S-N curve and explain RR Moore test for fatigue in materials  Explanation	2 M 3 M
4 (c)	Gibbs Phase rule for solid solution For deriving P+F=C+2	5 M

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Signature of Chief Academic Coordinator Signature of Principal

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Bengaluru - 560 109.

Set - B.

K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109

I SESSIONAL TEST QUESTION PAPER 2018 - 19 ODD SEMESTER

USN | | | | | | | | | |

Degree : B.E
Branch : Mechanical Engineering
Course Title : Material Science
Duration : 90 Minutes

Semester : III
Course Code : 17ME32
Date : 14.09.2018
Max Marks : 30

Note: Answer ONE full question from each part.

Q No.	Question	Marks	CO mapping	K-Level
	PART-A			
1(a)	Calculate the atomic packing factor of BCC unit cell.	5	CO1	K2 (Understand)
(b)	Classify crystal imperfections and explain point & line defects.	5	CO1	K2 (Understand)
(c)	Explain the types of solid solutions in detail.	5	CO2	K2 (Understand)
	OR			
2(a)	Discuss Critically Resolved Shear Stress (CRSS) on the slip plane with an expression.	5	CO1	K2 (Understand)
(b)	Explain briefly the mechanical properties of a material in plastic range.	5	CO1	K2 (Understand)
(c)	Discuss the factors affecting substitutional solid solubility (Hume Rothary rules).	5	CO2	K2 (Understand)
	PART-B			
3(a)	Illustrate the phenomenon and mechanisms of Diffusion.	5	CO1	K2 (Understand)
(b)	Summarize the different stages in ductile fracture with a neat sketch.	5	CO1	K2 (Understand)
(c)	Explain the Gibbs Phase rule for solid solution.	5	CO2	K2 (Understand)
	OR			
4(a)	Explain creep in materials by showing different stages of creep with a creep curve.	5	CO1	K2 (Understand)
(b)	Draw a neat sketch of S-N curve and explain RR Moore test for fatigue in materials	5	CO1	K2 (Understand)
(c)	Explain the eutectic and eutectoid binary phase diagrams with neat sketches.	5	CO2	K2 (Understand)

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Signature of Chief Academic Coordinator

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K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109
II SESSIONAL TEST QUESTION PAPER 2018 - 19 ODD SEMESTER

SET – A

USN | | | | | | | | | |

Degree : B.E
Branch : Mechanical Engineering
Course Title : Material Science
Duration : 90 Minutes

Semester : III
Course Code : 17ME32
Date : 25.10.2018
Max Marks : 30

Note: Answer ONE full question from each part.

Q No.	Question	Marks	CO mapping	K-Level
	PART-A			
1(a)	Illustrate the Iron-Carbon (Fe-Fe3C) equilibrium diagram along with different phases and invariant reactions with a neat sketch.	5	CO2	K2 (Understanding)
(b)	Distinguish between Austempering and Martempering.	5	CO3	K2 (Understanding)
(c)	Explain the process of flame hardening with a neat sketch.	5	CO3	K2 (Understanding)
	OR			
2(a)	Illustrate the various types of carbon steels.	5	CO2	K2 (Understanding)
(b)	Interpret the TTT curve for eutectoid steel and explain briefly.	5	CO3	K2 (Understanding)
(c)	Outline the different properties of Grey Cast Iron and White Cast Iron.	5	CO3	K2 (Understanding)
	PART-B			
3(a)	Differentiate between homogenous and heterogeneous nucleation.	5	CO2	K2 (Understanding)
(b)	Discuss the process of hardenability by Jominy End-Quench test.	5	CO3	K2 (Understanding)
(c)	Write a note on different methods of carburizing.	5	CO3	K2 (Understanding)
	OR			
4(a)	Explain the process of mechanism of solidification.	5	CO2	K2 (Understanding)
(b)	Discuss on various types of cast iron with necessary microstructures.	5	CO3	K2 (Understanding)
(c)	Summarize the various types of annealing process.	5	CO3	K2 (Understanding)

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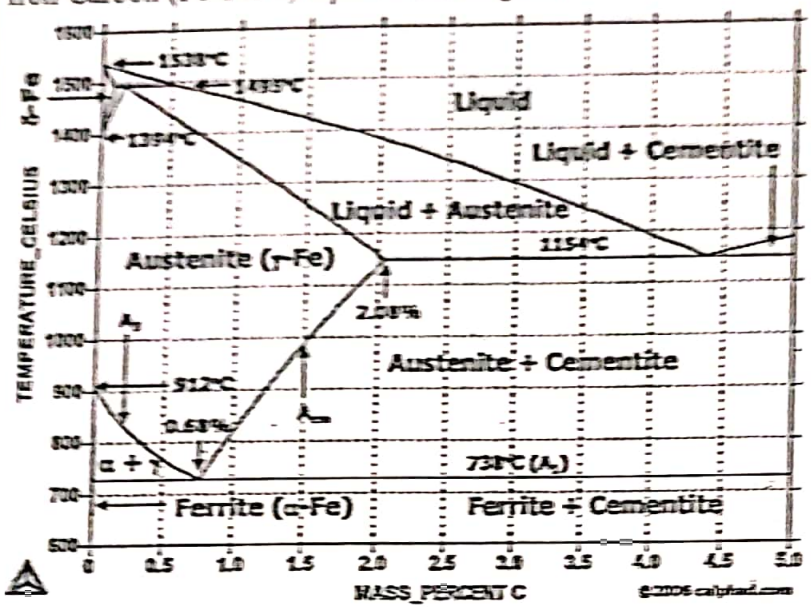
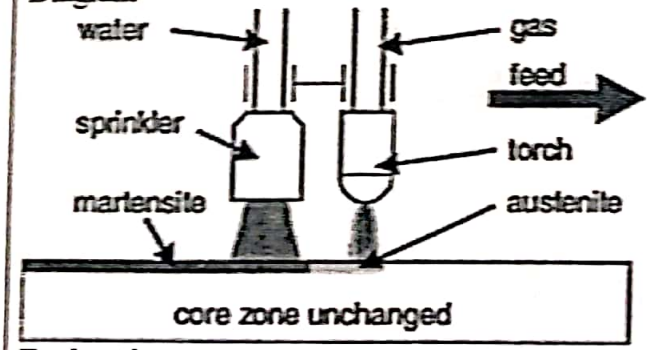
K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109

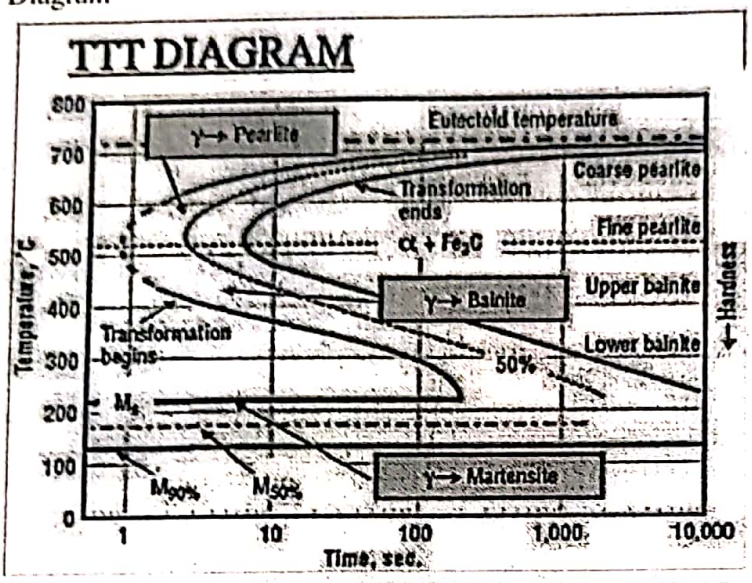
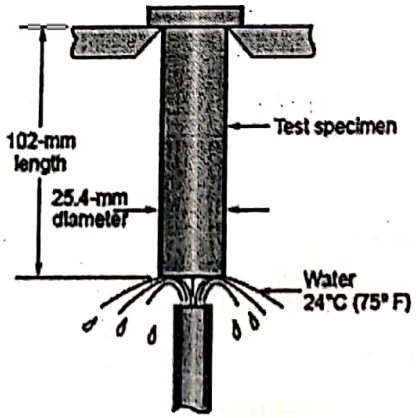
II SESSIONAL TEST QUESTION PAPER 2018 – 19 ODD SEMESTER

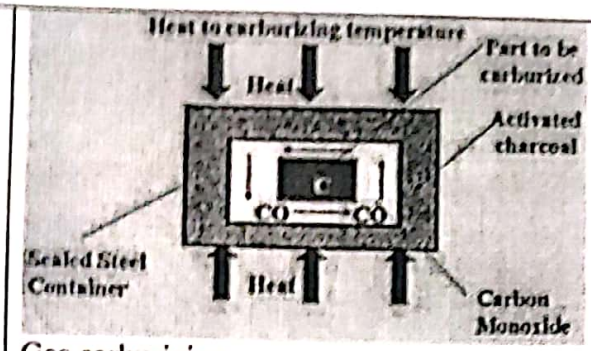
SCHEME AND SOLUTION

Degree : B.E
Branch : Mechanical Engineering
Course Title : Material Science

Semester : III
Course Code : 17ME32
Max Marks : 30

Q.NO.	POINTS	MARKS
1 (a)	Iron-Carbon (Fe-Fe3C) equilibrium diagram	
		1 M
	Explanation on curve	1 M
	Explaining six phases i.e, Ferrite, Austenite, Delta Iron, Pearlite, Cementite and ledlburite	2 M
	Three invariant reactions	1 M
1 (b)	Any five differences between betweenAustempering and Martempering	5 M
1 (c)	Process of flame hardening	
	Diagram	2 M
		
	Explanation on process	3 M

2 (a)	Explanation on various types of carbon steels Low carbon steels Medium carbon steels High carbon steels Ultra High carbon steels	1 M 1 M 2 M 1 M
2 (b)	TTT curve for eutectoid steel Diagram  Explanation	2 M 3 M
2 (c)	Atleast six properties from Grey Cast Iron and White Cast Iron	5 M
3 (a)	Five differences between homogenous and heterogeneous nucleation	5 M
3 (b)	Jominy End-Quench test Diagram  Explanation	2 M 3 M
3 (c)	Explanation on following Carburizing methods Pack carburizing	1 M

	 Gas carburizing Liquid carburizing	1 M 2 M 1 M
4 (a)	Process of mechanism of solidification Explanation about formation of dendrites (nucleation) Explanation about crystal growth	 2 ½ M 2 ½ M
4 (b)	Types of cast iron Grey Cast Iron White Cast Iron Spheridal Cast Iron	 1 ½ M 1 ½ M 2 M
4 (c)	Types of annealing process Full annealing Process annealing Spheroidizing annealing Stress relief annealing	 1 M 2 M 1 M 1 M

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K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109
II SESSIONAL TEST QUESTION PAPER 2018 – 19 ODD SEMESTER

SET – B

USN | | | | | | | | | |

Degree : B.E
Branch : Mechanical Engineering
Course Title : Material Science
Duration : 90 Minutes

Semester : III
Course Code : 17ME32
Date : 25.10.2018
Max Marks : 30

Note: Answer ONE full question from each part.

Q No.	Question	Marks	CO mapping	K-Level
	PART-A			
1(a)	**Explain** the mechanism of Solidification in pure metals & alloys.	5	CO2	K2 (Understanding)
(b)	**Interpret** the TTT curve for eutectoid steel and explain briefly.	5	CO3	K2 (Understanding)
(c)	**Outline** the different properties of Grey Cast Iron and White Cast Iron.	5	CO3	K2 (Understanding)
	OR			
2(a)	**Illustrate** the Iron-Carbon equilibrium diagram along with different phases and invariant reactions with a neat sketch.	5	CO2	K2 (Understanding)
(b)	**Write a note** on different methods of carburizing.	5	CO3	K2 (Understanding)
(c)	**Distinguish** between Austempering and Martempering.	5	CO3	K2 (Understanding)
	PART-B			
3(a)	**Illustrate** the various types of carbon steels.	5	CO2	K2 (Understanding)
(b)	**Discuss** on various types of cast iron with necessary microstructures.	5	CO3	K2 (Understanding)
(c)	**Differentiate** Annealing and Normalizing process.	5	CO3	K2 (Understanding)
	OR			
4(a)	**Differentiate** between homogenous and heterogeneous nucleation.	5	CO2	K2 (Understanding)
(b)	**Explain** the process of flame hardening with a neat sketch.	5	CO3	K2 (Understanding)
(c)	**Discuss** the process of hardenability by Jominy End-Quench test.	5	CO3	K2 (Understanding)

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III SESSIONAL TEST QUESTION PAPER 2018 – 19 ODD SEMESTER

SET – A

USN | | | | | | | | | |

Degree : B.E
Branch : Mechanical Engineering
Course Title : Material Science
Duration : 90 Minutes

Semester : III
Course Code : 17ME32
Date : 22.11.2018
Max Marks : 30

Note: Answer ONE full question from each part.

Q No.	Question	Marks	CO mapping	K-Level
	PART-A			
1(a)	Discuss the different properties of shape memory alloys.	5	CO4	K2 (Understanding)
(b)	Write a note on piezoelectric materials and its applications.	5	CO4	K2 (Understanding)
(c)	Classify the different types of composites and explain.	5	CO5	K2 (Understanding)
	OR			
2(a)	Explain the different types of smart materials.	5	CO4	K2 (Understanding)
(b)	Differentiate between Thermo-Setting and Thermo-Plastic polymers.	5	CO4	K2 (Understanding)
(c)	Derive an expression for Longitudinal Young's modulus of a fibre reinforced composites under the Iso-Strain condition.	5	CO5	K3 (Applying)
	PART-B			
3(a)	Interpret the need for Residual Life Assessment of the materials.	5	CO4	K2 (Understanding)
(b)	Explain the Non-destructive testing methods useful for assessing residual life of materials.	5	CO4	K2 (Understanding)
(c)	Outline the process of filament winding method.	5	CO5	K2 (Understanding)
	OR			
4(a)	Illustrate the process of Resin Transfer Moulding.	5	CO4	K2 (Understanding)
(b)	Sketch and explain the process of Injection Moulding method.	5	CO4	K2 (Understanding)
(c)	Calculate the tensile modulus of elasticity of unidirectional carbon-fibre reinforced composite containing 62% of carbon fibres by volume in iso-stress and iso-strain condition. Assume $E_{carbon\ fibre} = 3.86 \times 10^4$ kgf/mm^2 and $E_{Epoxy} = 4.28 \times 10^2$ kgf/mm^2.	5	CO5	K3 (Applying)

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Bangalore - 560 109

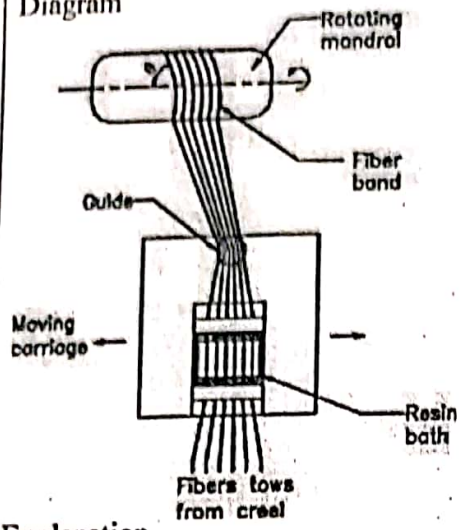
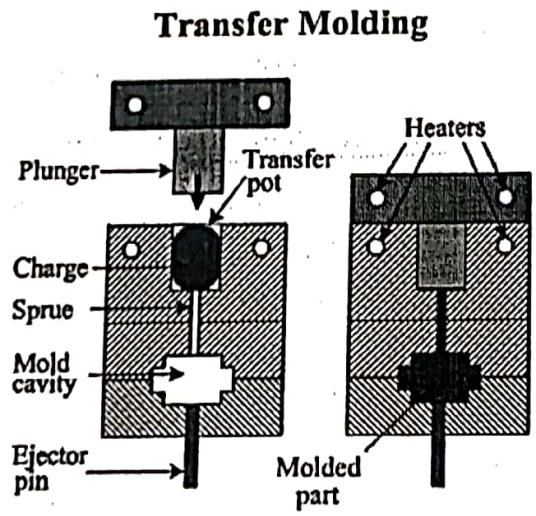
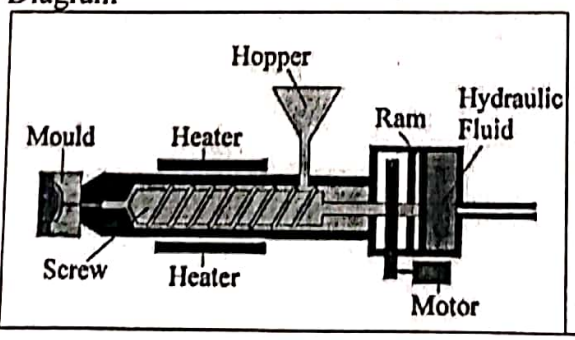
Signature of Principal

K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109
III SESSIONAL TEST QUESTION PAPER 2018 – 19 ODD SEMESTER

SCHEME AND SOLUTION

Degree : **B.E** **Semester** : **III**
Branch : **Mechanical Engineering** **Course Code** : **17ME32**
Course Title : **Material Science** **Max Marks** : **30**

Q.NO.	POINTS	MARKS
1 (a)	Properties of shape memory alloy (a) Shape memory effect (b) Pseudo-elasticity	 2 ½ M 2 ½ M
1 (b)	Brief explanation about piezoelectric materials Applications of piezoelectric materials	3 M 2 M
1 (c)	Classification of composities 1. Based on matrix a) Metal Matrix Composites b) Polymer Matrix Composites c) Ceramic Matrix Composites 2. Based on reinforcement a) Fibre Reinforced Composites b) Particulate Reinforced Composites c) Laminated Reinforced Composites	 2 ½ M 2 ½ M
2 (a)	Explanation on different types of smart materials i. Piezoelectric materials ii. Electro-Rheostatic materials iii. Quantum Tunneling Composites iv. Color changing materials (thermo-chromic and photo-chromic) v. Shape memory alloys.	 1 M 1 M 1 M 1 M 1 M
2 (b)	Any five differences between Thermo-Setting and Thermo-Plastic polymers	5 M
2 (c)	Derivation for Longitudinal Young's Modulus For finding, $\sigma_C = \sigma_f V_f + \sigma_m V_m$ $E_C \varepsilon_C = E_f \varepsilon_f V_f + E_m \varepsilon_m V_m$ $(E_C)_L = E_f V_f + E_m V_m$	3 M 1 M 1 M
3 (a)	Brief explanation about the need for Residual Life Assessment of the materials	5 M
3 (b)	Non-destructive testing methods useful for assessing residual life of materials i. Thermography test ii. Ultrasonic test iii. Liquid penetrant test	 1 M 1 M 1 M

	iv. Magnetic particle test Metallography test	1 M 1 M
3 (c)	Filament winding process Diagram  Explanation	2 M 3 M
4 (a)	Process of Resin Transfer Moulding Diagram  Explanation	2 M 3 M
4 (b)	Process of injection moulding Diagram  	2 M

	Explnation	
4 (c)		3 M
	Numerical solution For finding $V_m = 0.38$	1 M
	(i) Iso-stress condition	
	$(E_C)_T = \frac{E_f E_m}{E_f V_m + E_m V_f}$	1 M
	$(E_C)_T = 0.1085\ X\ 10^5\ N/mm^2$	1 M
	(ii) Iso-strain condition	
	$(E_C)_L = E_f V_f + E_m V_m$	1 M
	$(E_C)_L = 2.36\ X\ 10^5\ N/mm^2$	1 M

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Signature of Chief Academic Coordinator **Signature of Principal**

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K.S. Institute of Technology
Bengaluru 560 109.

K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109
III SESSIONAL TEST QUESTION PAPER 2018 – 19 ODD SEMESTER

SET – B

USN | | | | | | | | | |

Degree : B.E
Branch : Mechanical Engineering
Course Title : Material science
Duration : 90 Minutes

Semester : III A&B
Course Code : 17ME32
Date : 22/11/18
Max Marks : 30

Note: Answer ONE full question from each part.

Q No.	Question	Marks	CO mapping	K-Level
	PART-A			
1(a)	Explain different types of smart materials.	5	CO4	K2(Understanding)
(b)	Differentiate between Thermo-Setting and Thermo-Plastic polymers.	5	CO4	K2(Understanding)
(c)	Classify different types of composites	5	CO5	K2(Understanding)
	OR			
2(a)	Discuss different properties of shape memory alloys with examples.	5	CO4	K2(Understanding)
(b)	Write a note on piezoelectric materials and its applications.	5	CO4	K2(Understanding)
(c)	Explain Filament moulding process with a neat sketch.	5	CO5	K2(Understanding)
	PART-B			
3(a)	Explain the role of Matrix and reinforcement in composite.	5	CO4	K2(Understanding)
(b)	Discuss applications and advantages of polymer matrix composites.	5	CO4	K2(Understanding)
(c)	Derive an expression for Longitudinal Young's modulus of a fibre reinforced composites under the Iso-Strain condition.	5	CO5	K3 (Applying)
	OR			
4(a)	Illustrate the process of Resin Transfer Moulding.	5	CO4	K2(Understanding)
(b)	Explain Properties of ceramics and metal matrix composites.	5	CO4	K2(Understanding)
(c)	Calculate the tensile modulus of elasticity of unidirectional carbon-fibre reinforced composite containing 62% of carbon fibres by volume in iso-stress and iso-strain condition. Assume $E_{carbon\ fibre} = 3.86 \times 10^4$ kgf/mm^2 and $E_{Epoxy} = 4.28 \times 10^2$ kgf/mm^2.	5	CO5	K3 (Applying)

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Signature of Chief Academic Coordinator Signature of Principal

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K.S. Institute of Technology
Bengaluru - 560 109.

Materials Science	
17ME32.1	Describe the mechanical properties of metals, their alloys and various modes of failure.
17ME32.2	Understand the microstructures of ferrous and nonferrous materials to mechanical properties.
17ME32.3	Explain the processes of heat treatment of various alloys.
17ME32.4	Understand the properties and potentialities of various materials available and material selection procedures.
17ME32.5	Know about composite materials and their processing as well as applications.

17ME32.1	3	1	-	-	2	1	-	-	1	-	-	1	3	1
17ME32.2	3	1	1	-	2	1	-	-	1	-	-	1	3	1
17ME32.3	3	2	1	-	2	1	-	-	1	-	-	1	3	2
17ME32.4	3	2	2	-	2	1	-	-	1	-	-	1	3	1
17ME32.5	3	1	-	-	2	-	-	-	1	-	-	1	3	1
AVG	**3**	**1.4**	**1.33**	**-**	**2**	**1**	**-**	**-**	**1**	**-**	**-**	**1**	**3**	**1.2**

K S INSTITUTE OF TECHNOLOGY

DEPARTMENT OF MECHANICAL ENGINEERING

YEAR / SEMESTER	**II / III**
COURSE TITLE	**MATERIAL SCIENCE**
COURSE CODE	**17ME32**
ACADEMIC YEAR	**2018-19**

CO Attainment Level	Significance
Level 3	60% and above students should have scored >= 60% of Total marks
Level 2	55% to 59% of students should have scored >= 60% of Total marks
Level 1	50% to 54% of students should have scored >= 60% of Total marks

For Direct attainment , 50% of CIE and 50% of SEE marks are considered.
For indirect attainment, Course end survey is considered.
CO attainment is 90%of direct attainment + 10% of Indirect atttainment.
PO attainment = CO-PO mapping strength/3 * CO attainment .

Sl. No	USN	Name of the Student	15ME33																													
			IA1					A1					IA2					A2					IA3					A3					SEE
			CO1	CO2	CO3	CO4	CO5	CO1	CO2	CO3	CO4	CO5	CO1	CO2	CO3	CO4	CO5	CO1	CO2	CO3	CO4	CO5	CO1	CO2	CO3	CO4	CO5	CO1	CO2	CO3	CO4	CO5	
			20	10				6	4					10	20				6	4						20	10				6	4	60
1	1KS17ME004	ADITI.R.S.SINGH	13	5				6	4					9	15				6	4						17	10				6	4	26
2	1KS17ME052	PRITHVI.B	19	9				6	4					6	17				6	4						14	8				6	4	49
3	1KS17ME053	PUNEETH GOWDA.N	17	2				6	4					6	15				6	4						14	7				6	4	42
4	1KS17ME055	R.JAIKRISHNA	16	8				6	4					8	17				6	4						17	8				6	4	42
5	1KS17ME056	RAGHUNANDAN.M	19.5	5.5				6	4					7	17				6	4						18	9				6	4	39
6	1KS17ME057	RAGHUNANDAN.M.C	17	8				6	4					8	15				6	4						16	7				6	4	39
7	1KS17ME059	RAJATH.N.R	16	6				6	4					7	10				6	4						14	7				6	4	38
8	1KS17ME061	RANJEET.R.KULKARNI	19	8				6	4					8	14				6	4						18	7				6	4	39
9	1KS17ME062	RAVI.K.V	16	7				6	4					9	17				6	4						17	9				6	4	38
10	1KS17ME063	RUDRAPADA BHARAT KUMAR	6	9				6	4					4	17				6	4						12	10				6	4	
11	1KS17ME064	S.R.RETHINA SEELAN	15	10				6	4					7	16				6	4						14	7				6	4	34
12	1KS17ME065	SANDEEP.S.P	17	5				6	4					9	18				6	4						16	9				6	4	45
13	1KS17ME066	SANTHOSH.G	15	7				6	4					8	17				6	4						19	8				6	4	45
14	1KS17ME067	SATWIK SHIVARAM BHAT	19	9				6	4					7	17				6	4						18	10				6	4	50
15	1KS17ME068	SHANKAR RAM.S	14	1				6	4					6	13				6	4						15	10				6	4	35
16	1KS17ME069	SHARATH.N	19	8				6	4					6	18				6	4						19	7				6	4	36
17	1KS17ME071	SHASHANK.L	15	6				6	4					14	13				6	4						4	16				6	4	34
18	1KS17ME075	SHASHI KUMAR.G	15	9				6	4					7	11				6	4						15	10				6	4	39
19	1KS17ME076	SHASHIKIRAN.S	5	14				6	4					6	14				6	4						18	10				6	4	33
20	1KS17ME077	SHOAIB MAHABOOB SHAIK	15	6				6	4					9	16				6	4						15	7				6	4	40
21	1KS17ME078	SHREYAS.S	9	17				6	4					8	18				6	4						15	10				6	4	47
22	1KS17ME080	SIDDESH.S	15	2				6	4					9	15				6	4						18	9				6	4	38
23	1KS17ME081	SKANDA.S	4					6	4					6	7				6	4						9	9				6	4	28
24	1KS17ME083	SOWRAV.A	5	0				6	4					4	13				6	4						9	8				6	4	26
25	1KS17ME084	T.M.CHETHAN KUMAR	10	0				6	4					6	10				6	4						11	10				6	4	16
26	1KS17ME085	TANUSHREE.C	16	6				6	4					10	17				6	4						17	10				6	4	45
27	1KS17ME086	TEJAS.P	18	9				6	4					8	18				6	4						15	10				6	4	47
28	1KS17ME087	TULASIPRASAD.C	16	6				6	4					8	17				6	4						12	6				6	4	31
29	1KS17ME088	UDAY.R	11	4				6	4					5	14				6	4						10	1				6	4	21
30	1KS17ME089	V.JAYANTH	15	5				6	4					8	16				6	4						12	10				6	4	43
31	1KS17ME090	V.VINAY	13	10				6	4					10	16				6	4						15	8				6	4	45
32	1KS17ME091	VARUN.S.KADAM	17	6				6	4					9	17				6	4						19	10				6	4	39
33	1KS17ME092	VASUNIDHI.S	13	4				6	4					8	18				6	4						13	9				6	4	28
34	1KS17ME093	VENKATESH.K	15	4				6	4					7	17				6	4						16	8				6	4	30
35	1KS17ME094	VENKATESH PRASAD.G	19	1				6	4					7	17				6	4						19	9				6	4	44
36	1KS17ME095	VIKAS.K.C	13	2				6	4					8	13				6	4						9	10				6	4	29
37	1KS17ME096	VISHNU TEJAS.T.M	6	8				6	4					6	13				6	4						17	10				6	4	50
38	1KS17ME097	YASHAS.G.V	18	7				6	4					9	15				6	4						19	10				6	4	43
60% of Maximum marks (X)			12	06				04	02					06	12				04	02						12	06				04	02	36
No. of students above X			08	17				38	38					35	34				38	38						32	37				38	38	24
Total number of students (Y)			38	37				38	38					38	38				38	38						38	38				38	38	37
CO Percentage			21.05	45.95				100.00	100.00					92.11	89.47				100.00	100.00						84.21	97.37				100.00	100.00	64.86
			CO1	CO2				CO1	CO2					CO2	CO3				CO2	CO3						CO4	CO5				CO4	CO5	SEE
LEVEL			0	0				3	3					3	3				3	3						3	3				3	3	3

Method 1							
CO	**CIE**	**SEE**	**DIRECT ATTAINMENT**	**Level**	**COURSE EXIT SURVEY**	**LEVEL**	**ATTAINMENT**
CO1	**20.18**	**64.86**	**42.52**	**0.00**	**60.00**	**3.00**	**0.3**
CO2	**56.34**	**64.86**	**60.60**	**3.00**	**60.00**	**3.00**	**3**
CO3	**31.58**	**64.86**	**48.22**	**0.00**	**60.00**	**3.00**	**0.3**
CO4	**30.70**	**64.86**	**47.78**	**0.00**	**60.00**	**3.00**	**0.3**
CO5	**32.89**	**64.86**	**48.88**	**0.00**	**60.00**	**3.00**	**0.3**
AVERAGE							**0.84**

	IA1	A1	IA2	A2	IA3	A3	AVG
CO1	21.05	100.00	00.00	00.00	00.00	00.00	20.18
CO2	45.95	100.00	92.11	100.00	00.00	00.00	56.34
CO3	00.00	00.00	89.47	100.00	00.00	00.00	31.58
CO4	00.00	00.00	00.00	00.00	84.21	100.00	30.70
CO5	00.00	00.00	00.00	00.00	97.37	100.00	32.89

Co-Po Mapping Table														
CO'S	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PS01**	**PSO2**
CO1	3	1	1	-	2	1	-	-	-	-	-	1	2	1
CO2	3	2	-	-	-	-	-	-	-	-	-	1	1	1
CO3	3	2	-	-	-	-	-	-	-	-	-	1	2	1
CO4	3	1	1	-	-	-	-	-	-	-	-	1	2	1
CO5	3	1	2	-	-	-	-	-	1	-	-	1	2	2
AVG	3.00	1.40	1.33	_	2.00	1.00	_	_	1.00	_	_	1.00	1.80	1.20

PO ATTAINMENT TABLE															
CO'S	**CO Attainment in %**	**CO RESULT**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PS02**
CO1	0.30	N	0.30	0.10	0.10	-	0.20	0.10	-	-	-	-	-	0.10	0.20	0.10
CO2	3.00	Y	3.00	2.00	-	-	-	-	-	-	-	-	-	1.00	1.00	1.00
CO3	0.30	N	0.30	0.20	-	-	-	-	-	-	-	-	-	0.10	0.20	0.10
CO4	0.30	N	0.30	0.10	0.10	-	-	-	-	-	-	-	-	0.10	0.20	0.10
CO5	0.30	N	0.30	0.10	0.20	-	-	-	-	-	0.10	-	-	0.10	0.20	0.20
Average			0.84	0.50	0.13	_	0.20	0.10	_	_	0.10	_	_	0.28	0.36	0.30