MATHEMATICS – Third Semester B. Tech

(For all branches except Computer Science and Information Technology)

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
MAT201	PARTIAL DIFFERENTIAL EQUATIONS AND COMPLEX ANALYSIS	BASIC SCIENCE COURSE	3	1	0	4

Preamble: This course introduces basic ideas of partial differential equations which are widely used in the modelling and analysis of a wide range of physical phenomena and has got application across all branches of engineering. To understand the basic theory of functions of a complex variable, residue integration and conformal transformation.

Prerequisite: A basic course in partial differentiation and complex numbers**.**

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

CO 1	Understand the concept and the solution of partial differential equation.
CO 2	Analyse and solve one dimensional wave equation and heat equation.
CO 3	Understand complex functions, its continuity differentiability with the use of Cauchy-Riemann equations.
CO 4	Evaluate complex integrals using Cauchy's integral theorem and Cauchy's integral formula, understand the series expansion of analytic function
CO 5	Understand the series expansion of complex function about a singularity and Apply residue theorem to compute several kinds of real integrals.

Mapping of course outcomes with program outcomes

PO's	Broad area
PO 1	Engineering Knowledge
PO 2	Problem Analysis
PO 3	Design/Development of solutions
PO 4	Conduct investigations of complex problems
PO 5	Modern tool usage
PO 6	The Engineer and Society
PO 7	Environment and Sustainability
PO 8	Ethics
PO 9	Individual and team work

PO 10	Communication
PO 11	Project Management and Finance
PO 12	Life long learning

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				2		2
CO 2	3	3	3	3	2	1				2		2
CO 3	3	3	3	3	2	1				2		2
CO 4	3	3	3	3	2	1				2		2
CO 5	3	3	3	3	2	1				2		2

Assessment Pattern

Bloom's Category	Continuous Assessment Tests(%)		End Semester Examination(%)
	1	2	
Remember	10	10	10
Understand	30	30	30
Apply	30	30	30
Analyse	20	20	20
Evaluate	10	10	10
Create			

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. Form the partial differential equation given $z = xf(x) + ye^2$
2. What is the difference between complete integral and singular integral of a partial differential equation
3. Solve $3z = xp + yq$
4. Solve $(p^2 + q^2)y = qz$
5. Solve $u_x - 2u_t = u$ by the method of separation of variables

Course Outcome 2 (CO2):

1. Write any three assumptions in deriving one dimensional wave equations
2. Derive one Dimensional heat equation
3. Obtain a general solution for the one dimensional heat equation $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial t^2}$
4. A tightly stretched flexible string has it's ends fixed at $x = 0$and $x = l$. At $t = 0$, the string is given a shape defined by $f(x) = \mu x(l - x)$ where μ is a constant
5. Find the temperature $u(x, t)$ in a bar which is perfectly insulated laterally whose ends are kept at $0°C$ and whose initial temperature (in degree Celsius) is $f(x) = x(10 - x)$ given that it's length is 10 cm and specific heat is 0.056cal/gram deg

Course Outcome 3(CO3):

1. Separate the real and imaginary parts of $f(z) = \frac{1}{1+z}$
2. Check whether the function $f(z) = \frac{Re(z^2)}{|z|}$ is continuous at $z = 0$ given $f(0) = 0$
3. Determine a and b so that function $u = e^{-\pi x} cosay$ is harmonic. Find it's harmonic conjugate.
4. Find the fixed points of $w = \frac{i}{2z-1}$
5. Find the image of $|z| \leq \frac{1}{2}$, $-\frac{\pi}{8} < argz < \frac{\pi}{8}$under $w = z^2$

Course Outcome 4(CO4):

1. Find the value of $\int_C exp(z^2)dz$ where C is $|z| = 1$
2. Integrate the function $\int_C \frac{sinz}{z+4iz} dz$ where C is $|z - 4 - 2i| = 6.5$
3. Evaluate $\int_C \frac{e^z}{\left(z-\frac{\pi}{4}\right)^3} dz$ where C is $|z| = 1$
4. Find the Maclaurin series expansion of $f(z) = \frac{i}{1-z}$ and state the region of convergence.
5. Find the image of $|z| = 2$ under the mapping $w = z + \frac{1}{z}$

Course Outcome 5 (CO5):

1. Determine the singularity of $exp\left(\frac{1}{z}\right)$
2. Find the Laurent series of $\frac{1}{z^2(z-i)}$ about $z = i$
3. Find the residues of $f(z) = \frac{50z}{z^3 + 2z^2 - 7z + 4}$
4. Evaluate $\int_C tan2\pi z \, dz$ where C is $|z - 0.2| = 0.2$
5. Evaluate $\int_0^{2\pi} \frac{d\theta}{\sqrt{2} - cos\,\theta}$

Syllabus

Module 1 (Partial Differential Equations) (8 hours)

(Text 1-Relevant portions of sections 17.1, 17.2, 17.3, 17.4, 17.5, 17.7, 18.1, 18.2)

Partial differential equations, Formation of partial differential equations –elimination of arbitrary constants-elimination of arbitrary functions, Solutions of a partial differential equations, Equations solvable by direct integration, Linear equations of the first order-Lagrange's linear equation, Non-linear equations of the first order -Charpit's method, Solution of equation by method of separation of variables.

Module 2 (Applications of Partial Differential Equations) (10 hours)

(Text 1-Relevant portions of sections 18.3,18.4, 18.5)

One dimensional wave equation- vibrations of a stretched string, derivation, solution of the wave equation using method of separation of variables, D'Alembert's solution of the wave equation, One dimensional heat equation, derivation, solution of the heat equation

Module 3 (Complex Variable – Differentiation) (9 hours)

(Text 2: Relevant portions of sections13.3, 13.4, 17.1, 17.2 , 17.4)

Complex function, limit, continuity, derivative, analytic functions, Cauchy-Riemann equations, harmonic functions, finding harmonic conjugate, Conformal mappings- mappings $w = z^2,, w = e^z,$. Linear fractional transformation $w = \frac{1}{z}$, fixed points, Transformation $w = sinz$

(From sections 17.1, 17.2 and 17.4 only mappings $w = z^2,, w = e^z, w = \frac{1}{z}$, $w = sinz$ and problems based on these transformation need to be discussed)

Module 4 (Complex Variable – Integration) (9 hours)

(Text 2- Relevant topics from sections14.1, 14.2, 14.3, 14.4,15.4**)**

Complex integration, Line integrals in the complex plane, Basic properties, First evaluation method-indefinite integration and substitution of limit, second evaluation method-use of a representation of a path, Contour integrals, Cauchy integral theorem (without proof) on simply connected domain,Cauchy integral theorem (without proof) on multiply connected domain Cauchy Integral formula (without proof), Cauchy Integral formula for derivatives of an analytic function, Taylor's series and Maclaurin series.,

Module 5 (Complex Variable – Residue Integration) (**9 hours**)

(Text 2- Relevant topics from sections16.1, 16.2, 16.3, 16.4 **)**

Laurent's series(without proof), zeros of analytic functions, singularities, poles, removable singularities, essential singularities, Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral using residue theorem, Residue integration of real integrals – integrals of rational functions of $cos\theta$ and $sin\theta$, integrals of improper integrals of the form

$\int_{-\infty}^{\infty} f(x)\,dx$ with no poles on the real axis. ($\int_{A}^{B} f(x)\,dx$ whose integrand become infinite at a point in the interval of integration is excluded from the syllabus),

Textbooks:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2018.

2. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, 2016.

References:

1. Peter V. O'Neil, Advanced Engineering Mathematics, Cengage, 7th Edition, 2012

Assignments

Assignment: Assignment must include applications of the above theory in the concerned engineering branches

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Partial Differential Equations**	
1.1	Partial differential equations, Formation of partial differential equations –elimination of arbitrary constants-elimination of arbitrary functions, Solutions of a partial differential equations, Equations solvable by direct integration,	3
1.2	Linear equations of the first order- Lagrange's linear equation, Non-linear equations of the first order - Charpit's method	3
1.3	Boundary value problems, Method of separation of variables.	2
2	**Applications of Partial Differential Equations**	
2.1	One dimensional wave equation- vibrations of a stretched string, derivation,	1
2.2	Solution of wave equation using method of separation of variables, Fourier series solution of boundary value problems involving wave equation, D'Alembert's solution of the wave equation	4
2.3	One dimensional heat equation, derivation,	1
2.4	Solution of the heat equation, using method of separation of variables, Fourier series solutions of boundary value problems involving heat equation	4

3	**Complex Variable – Differentiation**	
3.1	Complex function, limit, continuity, derivative, analytic functions, Cauchy-Riemann equations,	4
3.2	harmonic functions, finding harmonic conjugate,	2
3.3	Conformal mappings- mappingsof $w = z^2, , w = e^z, w = \frac{1}{z}, w = sinz$.	3
4	**Complex Variable – Integration**	
4.1	Complex integration, Line integrals in the complex plane, Basic properties, First evaluation method, second evaluation method, use of representation of a path	4
4.2	Contour integrals, Cauchy integral theorem (**without proof**) on simply connected domain, on multiply connected domain(**without proof**) .Cauchy Integral formula (**without proof**),	2
4.3	Cauchy Integral formula for derivatives of an analytic function,	2
4.3	Taylor's series and Maclaurin series.	1
5	**Complex Variable – Residue Integration**	
5.1	Laurent's series(**without proof**)	2
5.2	zeros of analytic functions, singularities, poles, removable singularities, essential singularities, Residues,	2
5.3	Cauchy Residue theorem (**without proof**), Evaluation of definite integral using residue theorem	2
5.4	Residue integration of real integrals – integrals of rational functions of $cos\theta$and $sin\theta$, integrals of improper integrals of the form $\int_{-\infty}^{\infty} f(x)dx$with no poles on the real axis. ($\int_A^B f(x)dx$**whose integrand become infinite at a point in the interval of integration is excluded from the syllabus**),	3

Model Question Paper

(For all branches except Computer Science and Information Technology)

(2019 Scheme)

Reg No: Name:

APJ ABDULKALAM TECHNOLOGICAL UNIVERSITY

THIRD SEMESTER B.TECH. DEGREE EXAMINATION

(MONTH & YEAR)

Course Code:

Course Name: PARTIAL DIFFERENTIAL EQUATIONS AND COMPLEX ANALYSIS

MAX.MARKS: 100 DURATION: 3 Hours

PART A

Answer all questions, each carries 3 marks.

1. Derive a partial differential equation from the relation $z = f(x + at) + g(x - at)$
2. Solve $\frac{\partial^2 z}{\partial x \partial y} = x^2 y$
3. State any three assumptions in deriving the one dimensional wave equation
4. What are the possible solutions of one-dimensional heat equation?
5. If $f(z) = u + iv$ is analytic, then show that u *and* v are harmonic functions.
6. Check whether $f(z) = \bar{z}$ is analytic or not.
7. Evaluate $\int_c tan\, z\, dz$ where c is the unit circle.
8. Find the Taylor's series of $f(z) = \frac{1}{z}$ about $z = 2$.
9. What type of singularity have the function $f(z) = \frac{1}{\cos z - \sin z}$
10. Find the residue of $\frac{e^z}{z^3}$ at its pole.

PART B

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

Module-I

11. (a) Solve $x(y - z)p + y(z - x)q = z(x - y)$
    (b) Use Charpit's methods to solve $q + xp = p^2$
12. (a) Find the differential equation of all spheres of fixed radius having their centers in the xy-plane.

(b) Using the method of separation of variables, solve $\frac{\partial u}{\partial x} = 2\frac{\partial u}{\partial t} + u$, where $u(x,0) = 6e^{-3x}$.

Module – II

13. (a) Derive the solution of one dimensional wave equation $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$ with zero boundary conditions and with initial conditions $u(x,0) = f(x)$ and $\left(\frac{\partial u}{\partial t}\right)_{t=0} = 0$.

(b) A homogeneous rod of conducting material of length 100 cm has its ends kept at zero temperature and the temperature initially is $u(x,0) = \begin{cases} x, 0 \le x \le 50 \\ 100 - x, 50 \le x \le 100 \end{cases}$. Find the temperature $u(x,t)$ at any time.

14. (a) A tightly stretched string of length l with fixed ends is initially in equilibrium position. It is set vibrating by giving each point a velocity $v_0 \sin^3\left(\pi x/l\right)$. Find the displacement of the string at any time.

(b) An insulated rod of length l has its ends A and B are maintained at $0^0 c$ and $100^0 C$ respectively under steady state condition prevails. If the temperature at B is suddenly reduced to $0^0 c$ and maintained at $0^0 c$, Find the temperature at a distance *x* from A at time t.

Module-III

15. (a) Show that $f(z) = e^z$ is analytic for all z. Find its derivative.

(b) Find the image of $|z - 2i| = 2$ under the transformation $w = \frac{1}{z}$

16. (a) Prove that the function $u(x,y) = x^3 - 3xy^2 - 5y$ is harmonic everywhere. Find its harmonic conjugate.

(b) Find the image of the infinite stripe $0 \le y \le \pi$ under the transformation $w = e^z$

Module-IV

17. (a) Evaluate $\int_0^{2+i} (\bar{z})^2 \, dz$, along the real axis to 2 and then vertically to $2 + i$

(b) Using Cauchy's integral formula evaluate $\int_c \frac{5z+7}{z^2+2z-3} dz$, where c is $|z - 2| = 2$

18. (a) Evaluate $\int_c \frac{\sin^2 z}{\left(z - \frac{\pi}{6}\right)^3} dz$, where C is $|z| = 1$.

(b) Expand $\frac{1}{(z-1)(z-2)}$ in the region $|z| < 1$

Module- V

19. (a) Expand $f(z) = \frac{z^2-1}{z^2-5z+6}$ in $2 < |z| < 3$ as a Laurent's series.

(b) Using contour integration evaluate $\int_0^{2\pi} \frac{d\theta}{2+\cos\theta}$

20. (a) Use residue theorem to evaluate $\int_c \frac{\cos h\, \pi z}{z^2+4} dz$ where are C is $|z| = 3$.

(b) Apply calculus of residues to evaluate $\int_{-\infty}^{\infty} \frac{1}{(x^2+1)^3} dx$.

RAT 201	PROCESSING AND PROPERTIES OF MATERIALS	CATEGORY	L	T	P	CREDIT
		PCC	3	1	0	4

Prerequisite: NIL

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

CO 1	Analyze the Structure of materials at different levels, basic conceptsof crystalline materials like unit cell, FCC, BCC.HCP.
CO 2	Explain the concept of phase & phase diagram & understand thebasic terminologies associated with metallurgy. Construction and Understanding,identification of phase diagrams and reactions
CO 3	Understand and suggest the heat treatment process & types.Significance of properties Vs microstructure. demonstrate the test used to find hardenability of steels
CO 4	Analyze the various surface hardening methods and understand their applications
CO 5	Explain features, classification, applications of non ferrous materials like Aluminium, Copper,Magnesium , composite, Polymers etc.
CO 6	Understand the electrical,thermal,magnetic and optical properties of materials

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	2									2
CO 2	3	2	3									2
CO 3	3	2	2									2
CO 4	3	3	3									2
CO 5	3	2	2									2
CO 6	3	1	2									2

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	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):

Analyze the Structure of materials at different levels, basic conceptsof crystalline materials like unit cell, FCC, BCC,HCP.

Course Outcome 2 (CO2) :

Explain the concept of phase & phase diagram & understand thebasic terminologies associated with metallurgy. Construction and Understanding,identification of phase diagrams and reactions

Course Outcome 3(CO3):

Understand and suggest the heat treatment process & types.Significance of properties Vs microstructure.demonstrate the test used to find hardenability of steels

Course Outcome 4 (CO4):

Analyze the various surface hardening methodes and understand their applications

Course Outcome 5 (CO5):

Explain features, classification, applications of non ferrous materials likeAluminum, Copper,Magnesium , composite, Polymers etc.

Course Outcome 6 (CO6):

Understand the electrical, thermal,magnetic and optical properties of materials

Syllabus

Module 1

Primary bonds: - characteristics of covalent, ionic and metallic bond, bond energy.Crystallography:- Crystal, space lattice, unit cell- BCC,FCC, HCP structures - short and long range order – effects of crystalline and amorphous structure on mechanical properties.Coordination number and radius ratio; theoretical density;simple problems - Polymorphism and allotropy.Miller Indices: - crystal plane and direction (brief review)- Attributes of miller indices for slip system, brittleness of BCC, HCP and ductility of FCC - Modes of plastic deformation: - Slip and twinning properties.Schmid's law, equation, critical resolved shear stress,correlation of slip system with plastic deformation in metals and applications.Mechanism of crystallization: Homogeneous and heterogeneous nuclei formation, under cooling, dendritic growth, grain boundary irregularity.Effects of grain size, grain size distribution, grain shape,grain orientation on dislocation/strength and creep resistance - Hall - Petch theory, simple problems

Module 2

Classification of crystal imperfections: - types of dislocation– effect of point defects on mechanical properties - forest of dislocation, role of surface defects on crack initiation.Significance of high and low angle grain boundaries on dislocation – driving force for grain growth and applications during heat treatment.Polishing and etching to determine the microstructure and grain size.Diffusion in solids, Fick’s laws, mechanisms, applications of diffusion in mechanical engineering, simple problems.

Module 3

Phase diagrams: - Limitations of pure metals and need of alloying - classification of alloys, solid solutions, Hume Rothery`s rule - equilibrium diagram of common types of binary systems: five types.Detailed discussion on Iron-Carbon equilibrium diagram with microstructure and properties changes in austenite, ledeburite, ferrite, cementite, special features of martensitetransformation, bainite, spheroidite etc. TTT for a eutectoid iron–carbon alloy, CCT diagram, applications - annealing, normalizing, hardening, spheroidizing.Tempering:-austermpering, martempering and ausforming- Comparative study on ductility and strength with structure of pearlite, bainite, spherodite, martensite, tempered martensite and ausforming.Hardenability, Jominy end quench test, applications-Surface hardening methods:- no change in surface composition methods :- Flame, induction, laser and electron beam hardening processes- change in surface composition methods :carburizing and Nitriding; applications.

Module 4

Principal Non ferrous Alloys: - Aluminium, Copper,Magnesium, Nickel, study of composition, properties,applications.Composites:- Need of development of composites -geometrical and spatial Characteristics of particles –classification - fiber phase: - characteristics, classifications -matrix phase:- functions – only need and characteristics of PMC, MMC, and CMC – applications of composites: aircraft applications, aerospace equipment and instrument structure, industrial applications of composites, marine applications, composites in the sporting goods industry, composite biomaterials. Deformation of Semi crystalline Polymers , Factors That Influence the Mechanical Properties of Semi crystalline Polymers ,Polymer Films,Deformation of Elastomers

Module 5

Electrical Properties-Ohm's Law,Electrical Conductivity,Electronic and Ionic Conduction,Energy Band Structures in Solids ,Conduction in Terms of Band and Atomic,Bonding Models ,Electron Mobility,Electrical Resistivity of Metals,Electrical Characteristics of Commercial Alloys .Thermal Properties-Heat Capacity,Thermal Expansion ,Materials of Importance—Invar and Other Low-Expansion Alloys ,Thermal Conductivity ,Thermal Stresses . Magnetic Properties- Basic Concepts Diamagnetism and Paramagnetism , Ferromagnetism , Antiferromagnetism and Ferrimagnetism The Influence of Temperature on Magnetic Behavior ,Hysteresis , Magnetic Anisotropy. Optical Properties-Electromagnetic Radiation, Light Interactions with Solids , Atomic and Electronic Interactions,Refraction, Reflection , Absorption , Transmission , Color, Opacity and Translucency in Insulators.

Text Books

1. Fundamentals of Materials Science and Engineering: An Integrated Approach - William D callister, David G. Rethwisch
2. Raghavan V, Material Science and Engineering, Prentice Hall,2004

Reference Books

1. Shackelford J., Introduction to Materials Science for Engineers, 7/e, Pearson, 2009.
2. Van Vlack L. H., Elements of Materials Science and Engineering, Addison-Wesley, 1989.
3. Lakhtin Y., Engineering Physical Metallurgy, Gordon and Breach Science Publishers, 1965.
4. Dieter G. E., Mechanical Metallurgy, McGraw-Hill, 1976.
5. Reed-Hill R. E., Physical Metallurgy, PWS-Kent Publishing Company, 1992.
6. Avner S. H., Introduction to Physical Metallurgy, McGraw-Hill, 1974.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Module -1**	
1.1	Primary bonds,covalent, ionic and metallic bond, bond energy	1
1.2	Crystallography,Crystal, space lattice, unit cell-simple problems	2
1.3	BCC,FCC, HCP structures,Coordination number and radius ratio, theoretical density;simple problems	2
1.4	Polymorphism and allotropy.Miller Indices: - crystal plane and direction	2
1.5	Modes of plastic deformation,Slip and twinning properties.Schmid's law, equation, critical resolved shear stress,correlation of slip system with plastic deformation in metals and applications	2
1.6	Mechanism of crystallization,Homogeneous and heterogeneous nuclei formation, under cooling	2
1.7	Dendritic growth, grain boundary irregularity.Effects of grain size, grain size distribution, grain shape	2
1.8	Strength and creep resistance - Hall - Petch theory, simple problems	2
2	**Module -2**	
2.1	Classification of crystal imperfections,types of dislocation,effect of point defects on mechanical properties , forest of dislocation, role of surface defects on crack initiation	2
2.2	Significance of high and low angle grain boundaries on dislocation , driving force for grain growth and applications during heat treatment	2
2.3	Polishing and etching to determine the microstructure and grain size	1
2.4	Fick's laws, mechanisms, applications of diffusion in mechanical engineering, simple problems.	2
3	**Module -3**	
	Classification of alloys, solid solutions, Hume Rothery`s rule , equilibrium diagram of common types of binary systems: five types	2
	Detailed discussion on Iron-Carbon equilibrium diagram	2
	TTT for a eutectoid iron–carbon alloy, CCT diagram, applications	2
	Annealing, normalizing, hardening, spheroidizing.Tempering:- austermpering, martempering and ausforming	2
	Study on ductility and strength with structure of pearlite, bainite, spherodite, martensite, tempered martensite and ausforming	2

	Hardenability, Jominy end quench test, applications-Surface hardening methods:- no change in surface composition methods:- Flame, induction, laser and electron beam hardening processes-change in surface composition methods :carburizing and Nitriding; applications.	2
4	**Module -4**	
	Non ferrous Alloys,Aluminum, Copper,Magnesium, Nickel, study of composition, properties,applications	1
	Composites,Need of development of composites ,fiberphase,matrix phase, characteristics of PMC, MMC, and CMC .	2
	Applications of composites: aircraft applications, aerospace equipment and instrument structure, industrial applications of composites, marine applications, composites in the sporting goods industry, composite biomaterials.	1
	Mechanical Properties of Semicrystalline Polymers ,Polymer Films,Deformation of Elastomers	1
5	**Module -5**	
	Electrical Properties-Ohm's Law,Electrical Conductivity,Electronic and Ionic Conduction,Energy Band Structures in Solids ,Conduction in Terms of Band and Atomic, Bonding Models,Electron Mobility,Electrical Resistivity of Metals,Electrical Characteristics of Commercial Alloys	1
	Thermal Properties-Heat Capacity,Thermal Expansion ,Materials of Importance—Invar and Other Low-Expansion Alloys ,Thermal Conductivity ,Thermal Stresses	1
	Magnetic Properties- Basic Concepts Diamagnetism and Paramagnetism , Ferromagnetism , Antiferromagnetism and Ferrimagnetism The Influence of Temperature on Magnetic Behavior ,Hysteresis , Magnetic Anisotropy	2
	Optical Properties- Electromagnetic Radiation, Light Interactions with Solids , Atomic and Electronic Interactions,Refraction, Reflection , Absorption , Transmission , Color, Opacity and Translucency in Insulators.	2

MODEL QUESTION PAPER

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
THIRD SEMESTER B.TECH. DEGREE EXAMINATION

Course Code: RAT 201

Course Name:PROCESSING AND PROPERTIES OF MATERIALS

Max. Marks: 100 **Duration: 3 Hours**

PART A

Answer all questions, each carries 3 marks. Marks

1		Cite the difference between atomic mass and atomic weight	(3)
2		What is the difference between atomic structure and crystal structure?	(3)
3		Draw an orthorhombic unit cell and within that cell a (210) plane	(3)
4		Calculate the number of atoms per cubic meter in aluminium	(3)
5		Briefly explain the difference between self-diffusion and inter diffusion.	(3)
6		Draw a general unary phase diagram and explain its various regions.	(3)
7		Derive the lever rule using in phase diagram.	(3)
8		Explain the flame hardening process.	(3)
9		Explain the surface nitriding process.	(3)
10		Briefly describe sandwich panels.	(3)

PART B

Answer any one full question from each module, each carries14 marks.

MODULE1

11	a)	For the HCP crystal structure,show that the ideal c/a ratio is 1.633	(6)
	b)	Show that the body centered cubic crystal structure that the unit cell edge length a and atomic radius R are related through $a = 4R/\sqrt{3}$	(8)
12	a)	Iron has a BCC crystal structure,an atomic radius of 0.124nm,and an atomic weight of 55.85g/mol. Compute its theoretical density.	(10)
	b)	Convert the (010) and (101) plane in to the four index Miller Bravies scheme for hexagonal unit cell	(4)

MODULE II

13	a)	Calculate the fraction of atom sites that are vacant for lead at its melting temperature of 600K .Assume an energy for vacancy formation of 0.55eV/atom.	(6)

	b)	For a given material,would you expect the surface energy to be greater than,the same as ,or less than the grain boundary energy? Why?	(8)
14	a)	Explain different types of crystal imperfections.	(10)
	b)	Cite the relative Burgers vector-dislocation line orientation for edge,screw and mixed dislocation.	(4)

MODULE III

15	a)	Explain Jominy end quench test.	(6)
	b)	Explain The TTT diagram for iron carbon alloy	(8)
16	a)	Explain the iron carbon phase diagram	(10)
	b)	Explain austempering process	(4)

MODULE IV

17	a)	Explain briefly why the tendency of a polymer to crystallize decrease with increasing molecular weight.	(8)
	b)	For a polymer matrix fiber reinforced composite (a)list three functions of matrix phase and (b)Compare the desired mechanical characteristics of matrix and fiber phase	(6)
18	a)	Make comparison of thermoplastic and thermosetting polymer on the basis of mechanical characteristics up on heating and according to possible molecular structure	(10)
	b)	What is a hybrid composite?. List two important advantages of hybrid composite over normal fiber composite.	(4)

MODULE V

19	a)	Briefly explain why some transparent material appeared colored where as others are colorless	(8)
	b)	What is the distinction between electronic and ionic conduction?	(6)
20	a)	Briefly describe the phenomenon of magnetic hysteresis and why it occur for ferromagnetic and ferrimagnetic materials.	(7)
	b)	For some ceramic materials,why does the thermal conductivity first decrease and then increase with rising temperature?	(7)

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RAT 203	ELECTRONIC DEVICES AND CIRCUITS	CATEGORY	L	T	P	CREDIT
		PCC	3	1	0	4

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

CO 1	Design of wave shaping circuits
CO 2	Design and analyse biasing schemes for transistor circuits
CO 3	Model and evaluate amplifier circuits
CO 4	Choose an amplifier with appropriate specifications for electronic circuit applications
CO 5	Design and analyse oscillator circuits
CO 6	Build and evaluate different waveform generation circuits using Op-amps and timer ICs

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	2	2		2						3
CO 2	3	2	2	2		1						3
CO 3	3	2	2	2		2						3
CO 4	3	2	2	2		2						3
CO 5	3	2	2	2		2						3
CO 6	3	2	2	2		2						3

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	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.

Module 1

Diode Circuits: Clipping circuits- Single level and two level clippers, Clamping circuits-Design of Zener voltage regulators

BJT biasing circuits: DC load line, Operating point of a BJT, Factors affecting stability of Q point, Fixing of operating point.

Biasing circuits - fixed bias, collector feedback bias, emitter bias and voltage divider bias, Bias compensation using diode and thermistor, Low frequency equivalent circuit of BJT. Common Emitter amplifier - Role of coupling and emitter bypass capacitors – AC Equivalent Circuit – h parameter model of BJT -Amplifier gains and impedances calculations using h equivalent circuit

Module 2

Field effect Transistors: Review of JFET and MOSFET construction, working and characteristics-Biasing a JFET and MOSFET using voltage divider bias–- CS and CD amplifiers – small signal models-FET as switch and voltage controlled resistance.

Frequency response of Amplifiers: Frequency Response characteristics of BJT and FET amplifier, Low frequency and High frequency analysis of BJT (Common Emitter) and FET (Common Source) amplifier **:** Miller effect capacitance, Miller's Theorem, Gain bandwidth product, hybrid Pi Model of BJT amplifier

Module 3

Multistage amplifiers: Different types of coupling - Direct, RC, & transformer coupled amplifiers - operation, advantages and disadvantages (Analysis not required)

Power amplifiers using BJT: Class A, Class B, Class AB and Class C power amplifiers, Conversion efficiency and distortion in power amplifiers

Feedback amplifiers: Positive and negative feedback, Effect of negative feedback on gain, input impedance, output impedance, band width and distortion, Basic feedback topologies - Gain, input and output impedance with feedback

Module 4

Oscillators: Oscillator operation, Bark Hausen's criterion, RC oscillators – working of BJT based RC phase shift and Wien bridge oscillators, LC Oscillators - working of BJT based Hartley, Colpitts - with derivation of frequency of oscillation for the above mentioned oscillators and Crystal oscillators

Operational amplifiers: Introduction, Basic block diagram, Ideal op-amp, transfer characteristics and op-amp parameters, gain, CMRR, slew rate etc, Equivalent circuit of ideal and practical op-amp, op-amp configurations- Open loop and closed loop configurations, -properties of ideal and practical opamp.

Basic Op-amp Circuits: Inverting and non-inverting amplifier, Scale changer, Voltage follower, Summing amplifier, Subtractor, Adder-subtractor

Module 5

Op-amp applications: Differential amplifier with single op-amp, Instrumentation amplifier, Integrators, Differentiators, Comparators, Zero crossing detector, Schmitt trigger; square, triangular and ramp generator using opamp, Effect of slew rate on wave form generation.

Specialized ICs and their applications:

Timer IC 555 - Block Diagram of IC 555, Astable and Monostable operations
Phase Locked Loop - Block Diagram of PLL IC 565, Operation, Lock and capture range
Voltage Regulators - Fixed voltage regulators, 78XX and 79XX series, Adjustable voltage regulators, IC 723 Voltage regulator.

Text Books

1. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", Pearson Education India, 11/e, 2013
2. Albert Malvino and David J. Bates, "Electronic Principles", Tata McGraw-Hill, 7/e, 2007
3. Gayakwad R. A., "Op-Amps and Linear Integrated Circuits", Pearson Education India, 4/e, 2015
4. Salivahanan S. and V. S. Kanchana Bhaaskaran, "Linear Integrated Circuits", McGraw Hill Education India, 2/e, 2015

Reference Books

1. Sedra A.S. and Smith K.C., "Microelectronics Circuits-Theory and Applications", Oxford University Press, 6/e, 2011
2. Jacob Millman and Arvin Grabel, "Micro Electronics", Tata McGraw-Hill, 2/e, 1999
3. Donald A. Neamen, "Electronic Circuits-Analysis and Design", McGraw Hill Education India, 3/e, 2007

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	MODULE 1	
1.1	**Diode Circuits:** Clipping circuits- Single level and two-level clippers, Clamping circuits-Design of Zener voltage regulators	3
1.2	**BJT biasing circuits:** DC load line, Operating point of a BJT, Factors affecting stability of Q point, Fixing of operating point. Biasing circuits - fixed bias, collector feedback bias, emitter bias and voltage divider bias, Bias compensation using diode and thermistor, Low frequency equivalent circuit of BJT. Common Emitter amplifier - Role of coupling and emitter bypass capacitors – AC Equivalent Circuit – h parameter model of BJT -Amplifier gains and impedances calculations using h equivalent circuit	7
2	MODULE 2	
2.1	**Field effect Transistors:** Review of JFET and MOSFET construction, working and characteristics, Biasing a JFET and MOSFET using voltage divider bias, CS and CD amplifiers, small signal models-FET as switch and voltage controlled resistance.	4
2.2	**Frequency response of Amplifiers** Frequency Response characteristics of BJT and FET amplifier Low frequency and High frequency analysis of BJT (Common Emitter) and FET (Common Source)amplifier Miller effect capacitance, Miller's Theorem, Gain bandwidth product, hybrid Pi Model of BJT amplifier	5
3	MODULE 3	

3.1	Multistage amplifiers**:** Different types of coupling - Direct, RC, & transformer coupled amplifiers -operation, advantages and disadvantages (Analysis not required)	1
3.2	**Power amplifiers using BJT:** Class A, Class B, Class AB and Class C power amplifiers, Conversion efficiency and distortion in power amplifiers.	3
3.3	**Feedback amplifiers:** Positive and negative feedback, Effect of negative feedback on gain, input impedance, output impedance, band width and distortion, Basic feedback topologies - Gain, input and output impedance with feedback	4
4	MODULE 4	
4.1	**Oscillators:** Oscillator operation, Bark Hausen's criterion, RC oscillators – working of BJT based RC phase shift and Wien bridge oscillators, LC Oscillators - working of BJT based Hartley, Colpitts - with derivation of frequency of oscillation for the above mentioned oscillators and Crystal oscillators.	4
4.2	**Operational amplifiers:** Introduction, Basic block diagram, Ideal op-amp transfer characteristics and op-amp parameters, gain, CMRR, slew rate etc Equivalent circuit of ideal and practical op-amp, op-amp configurations- Open loop and closed loop configurations, -properties of ideal and practical opamp.	3
4.3	**Basic Op-amp Circuits:** Inverting and non-inverting amplifier, Scale changer, Voltage follower, Summing amplifier, Subtractor, Adder-subtractor	2
5	MODULE 5	
5.1	**Op-amp applications:** Differential amplifier with single op-amp, Instrumentation amplifier-derivation of gain Integrators, Differentiators, Comparators, Zero crossing detector, Schmitt trigger; square, triangular and ramp generator using opamp, Effect of slew rate on wave form generation.	4
5.2	Specialized ICs and their applications: **Timer IC 555** - Block Diagram of IC 555, Astable and Monostable operations	2
5.3	**Phase Locked Loop** - Block Diagram of PLL IC 565, Operation, Lock and capture range.	1
5.4	**Voltage Regulators -** Fixed voltage regulators, 78XX and 79XX series, Adjustable voltage regulators, IC 723 Voltage regulator	2

MODEL QUESTION PAPER

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
THIRD SEMESTER B.TECH. DEGREE EXAMINATION

Course Code: RAT 203

Course Name: ELECTRONIC DEVICES AND CIRCUITS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks. Marks

1		A positive voltage clamping circuit and a positive shunt clipping circuit each have a ± 5V square wave input. Sketch the output waveform of each circuit.	(3)
2		Draw the h parameter model of BJT.	(3)
3		In a CE amplifier circuit, hfe =50, hie =1.3kΩ, Cbc= 5pF, RC =3kΩ, RL= 2.2 kΩ. Calculate the Miller capacitance.	(3)
4		Draw and Explain the drain characteristics of N channel Enhancement MOSFET.	(3)
5		Compare different multistage amplifiers.	(3)
6		Explain how cross over distortion is avoided in class AB amplifier.	(3)
7		Design a Wein bridge oscillator to generate a sinusoidal waveform of 2 kHz.	(3)
8		List the properties of ideal opamp.	(3)
9		Explain the effect of slew rate on waveform generation.	(3)
10		In an astable multivibrator using 555, RB = 750 Ω. Determine the values of RA and C to generate a 1.0 MHz clock that has a duty cycle of 25%.	(3)

PART B

Answer any one full question from each module, each carries14 marks.

MODULE1

11	a)	Define operating point and explain the factors affecting the operating point stability.	(6)
	b)	Explain any one compensation technique used for reducing the drift of operating point.	(8)
12	a)	Design a voltage divider bias circuit to operate from 15 V supply. The bias conditions are to be VCE = VE = 5V and IC = 5mA. Assume the transistor β is 100. Calculate the stability factors of the designed circuit.	(10)
	b)	Explain the role of coupling and emitter bypass capacitors in amplifier circuits.	(4)

MODULE II

13	a)	Draw the frequency response curve of CE amplifier and explain why the gain decreases at low and high frequencies	(6)
	b)	With a neat diagram explain the construction and characteristics of JFET.	(8)
14	a)	Using small signal model, derive the expression for Zi, Zo, AV, Ai of a CS amplifier circuit	(10)
	b)	Draw the hybrid pi model of BJT amplifier.	(4)

MODULE III

15	a)	Explain the effects of negative feedback.	(6)
	b)	Draw the circuit diagram and explain the working of two stage Transformer coupled amplifier. Discuss the important features and applications.	(8)
16	a)	Draw a negative voltage shunt feedback topology. Derive the Gain, input impedance and output impedance.	(10)
	b)	A transformer coupled class A power amplifier draws a current of 200mA from a collector supply of 10V, when no signal is applied to it. Determine i) Maximum output power ii) Maximum collector efficiency iii) Power rating of the transistor.	(4)

MODULE IV

17	a)	Draw the circuit of Hartley oscillator and derive the frequency of oscillation.	(8)
	b)	Explain the working of op-amp inverting amplifier. Derive the expression for its voltage gain.	(6)
18	a)	Draw the circuit of a three channel summer amplifier and derive the expression for output voltage. Design a summer having gains of 5dB, 10 dB and 15dB respectively for each channel.	(10)
	b)	Explain the basic principle of oscillator.	(4)

MODULE V

19	a)	Draw the elementary block diagram of PLL and explain.	(8)
	b)	Design a monostable multivibrator which produces an output pulse width of 1 ms using 555.	(6)
20	a)	Derive the overall gain in an instrumentation amplifier.	(7)
	b)	Draw the functional block diagram of IC 723 and explain its operation.	(7)

****

RAT 205	DIGITAL ELECTRONICS	CATEGORY	L	T	P	CREDIT
		PCC	3	1	0	4

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

CO 1	Represent numbers in different digital formats and to perform logical operations
CO 2	Choose a digital IC based on its characteristics
CO 3	Analyse and synthesise combinational logic circuits and to derive minimal logic functions
CO 4	Analyse and design sequential logic circuits
CO 5	Familiarize A/D and D/A conversion techniques
CO 6	Familiarizethe basic concepts of memory, programmable logic devices
CO 7	Design basic combinational and sequential logic circuits using Verilog

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	2	1	-							2
CO 2	2	3	3	2								2
CO 3	3	3	3	2		2						3
CO 4	3	3	3	2		2						3
CO 5	3	3	3	2		2						3
CO 6	3	2	2	2								2
CO 7	3	3	3	2	2	2						3

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	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.

Module 1

Number Systems and Codes- Decimal, Binary, Octal and hexadecimal and their conversions, ASCII code, Excess -3 code, Gray code; Binary addition and subtraction, unsigned and signed numbers, 1's complement and 2's complement arithmetic

Logic Gates – NOT, AND, OR, NAND, NOR, XOR, XNOR

Characteristics of digital ICs- Speed, Power dissipation, fan-out, current and voltage parameters, noise margin, operating temperature etc, TTL and CMOS Logic-NAND gate realisations- Comparison of TTL and CMOS families, TTL and CMOS Series Characteristics.

Module 2

Boolean Laws and Theorems- laws and rules of Boolean algebra, De Morgan's theorem; NAND and NOR implementations; Sum of Products form, product of sums form; K map representation and simplification (up to four variables)

Combinational circuits: Adders - Half adder and full adder, Subtractors, half subtractor and full subtractor , Ripple Carry Adder, Carry Look ahead adders,-1, Multiplexers, Demultiplexers, Encoders, BCD to decimal decoders

Module 3

Sequential circuits: Flip-Flops, SR-1, JK-1, D and T flip-flops, JK Master Slave Flip-flop, Conversion of flip-flops

Shift Registers -SISO, SIPO, PISO, PIPO.

Counters: Asynchronous Counters- up counter-down counter-decade counter; Mod N counters.

Module 4

Synchronous counter design: Ring counter -Johnson Counter - Mod N counter - Decade counter.

Digital to Analog conversion – R-2R ladder - weighted resistors; D/A converter specifications, D/A converter ICs, DAC-08-Typical Performance characteristics. Basic connection diagram, Familiarisation of DAC-0808, DAC 80, AD 7524

Analog to Digital Conversion -Flash ADC -Successive approximation; Integrating ADC., A/D converter specifications, A/D converter ICs-ADC 0800-Basic block diagram and working, Familiarisation of ADC 0808, AD 7820

Module 5

Memory - ROM -PROM – EPROM – RAM- Solid state drives

Sequential Programmable Logic Devices - PAL, PLA, FPGA

Introduction to Verilog, Design using Verilog basic gates, arithmetic circuits, basic- combinational and sequentiallogic circuits

Text Books:

1. Thomas L Floyd, Digital Fundamentals, 10e, Pearson Education 2011

2. Tocci R.J and N.S.Widmer, Digital Systems, Principles and Applications, 11/e, , Pearson Education
3. Albert P Malvino, Donald P Leach, Digital Principles and Applications, 8e, McGraw Hill

References:

1. M Morris Mano, Digital Logic and Computer Design, 4e, Pearson Education
2. S Salivahanan, S Arivazhagan, Digital Circuits and Design, 2e, Vikas Publishing House Pvt. Ltd
3. Taub& Shilling, Digital Integrated Electronics, McGraw Hill
4. 4. John F. Wakerly, Digital Design: Principles and Practices, 4/e, , Pearson, 2005

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**MODULE 1**	
1.1	Number Systems and Codes- Decimal, Binary, Octal and hexadecimal and their conversions, ASCII code, Excess -3 code, Gray code; Binary addition and subtraction, unsigned and signed numbers, 1's complement and 2's complement arithmetic	4
1.2	Logic Gates – NOT, AND, OR, NAND, NOR, XOR, XNOR	1
1.3	Characteristics of digital ICs- Speed, Power dissipation, fan-out, current and voltage parameters, noise margin, operating temperature etc, TTL and CMOS Logic-NAND gate realisations-current sourcing, current sinking, Totem-pole output circuit, Comparison of TTL and CMOS families, TTL and CMOS Series Characteristics.	4
2	**MODULE 2**	
2.1	Boolean Laws and Theorems- laws and rules of Boolean algebra, De Morgan's theorem; NAND and NOR implementations; Sum of Products form, product of sums form; K map representation and simplification (up to four variables)	5
2.2	Combinational circuits: Adders - Half adder and full adder , Subtractors, half subtractor and full subtractor, Ripple Carry Adder, Carry Look ahead adders, Multiplexers, Demultiplexers, Encoders, BCD to decimal decoders	4
3	**MODULE 3**	
3.1	Sequential circuits: Flip-Flops, SR, JK, D and T flip-flops, JK Master Slave Flip-flop, Conversion of flip-flops	4
3.2	Shift Registers -SISO, SIPO, PISO, PIPO.	2
3.3	Counters: Asynchronous Counters- up counter-down counter-decade counter; Mod N counters.	3
4	MODULE 4	

4.1	Synchronous counter design: Ring counter -Johnson Counter - Mod N counter - Decade counter.	3
4.2	Digital to Analog conversion – R-2R ladder - weighted resistors; D/A converter specifications, D/A converter ICs, DAC-08-Typical Performance characteristics. Basic connection diagram, Familiarisation of DAC-0808, DAC 80, AD 7524	3
4.3	Analog to Digital Conversion -Flash ADC -Successive approximation; Integrating ADC., A/D converter specifications, A/D converter ICs-ADC 0800-Basic block diagram and working, Familiarisation of ADC 0808, AD 7820	3
5	MODULE 5	
5.1	Memory - ROM -PROM – EPROM – RAM- Solid state drives	2
5.2	Sequential Programmable Logic Devices - PAL, PLA, FPGA	2
5.3	Introduction to Verilog, Design using Verilog basic gates, arithmetic circuits, basic combinational circuits, sequential logic circuits	5

MODEL QUESTION PAPER

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
THIRD SEMESTER B.TECH. DEGREE EXAMINATION

Course Code: RAT 205

Course Name: DIGITAL ELECTRONICS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks. Marks

1 Prove that A+ A'B + AB' = A + B (3)

2 Convert the hexadecimal number (B2D.FC)16 into decimal, binary and octal (3)

3 Using K map, derive the Boolean expression for (3)

$F(A, B, C, D) = \sum m(0, 1, 3, 4, 6, 9, 11) + d(2, 5)$

4 Draw the truth table for a half subtractor. Implement the circuit using logic gates. (3)

5 Draw the circuit diagram of a typical TTL NAND gate. (3)

6 Differentiate between asynchronous and synchronous counters. (3)

7 Explain the principle of working of a BCD to decimal decoder. (3)

8		Design a 3 bit ring counter.	(3)
9		Mention the significance of programmable logic devices.	(3)
10		Write a Verilog code for D Flipflop.	(3)

PART B

Answer any one full question from each module, each carries14 marks.

MODULE1

11	a)	Write a short note on classification of binary codes.	(6)
	b)	Perform the unsigned binary subtraction 10101101 – 01110111 by 1's complement method	(8)
12	a)	Convert the decimal number -25.125 to a single- precision floating point binary number.	(6)
	b)	Determine single error correcting code for the data 01110 using even parity.	(8)

MODULE II

13	a)	Explain the working of a carry look ahead adder with the help of a diagram.	(7)
	b)	Draw a 4 to 1 multiplexer using logic gates.	(7)
14	a)	Explain the working of a ripple carry adder with the help of a diagram.	(7)
	b)	Express the output logic function Y in standard SOP form and standard POS form.	(7)

A	B	C	Y
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	1

MODULE III

15	a)	Draw and explain the working of a JK Flipflop.	(6)
	b)	Explain with diagram the working of a 3 bit parallel in serial out shift register.	(8)
16	a)	Design a mod 10 counter and explain its timing diagram.	(8)
	b)	Design a 3 bit asynchronous down counter.	(6)

MODULE IV

17	a)	Explain the working of a successive approximation ADC.	(6)
	b)	Design a synchronous 4 bit up counter.	(8)
18	a)	With a neat diagram, explain the operation of a 3 bit Johnson counter.	(7)
	b)	With suitable diagram, explain the operation of a DAC.	(7)

MODULE V

19	a)	Differentiate between SRAM and DRAM with diagrams.	(8)
	b)	Describe the structure of a PLA.	(6)
20	a)	Differentiate between PROM, PLA and PAL.	(7)
	b)	Write Verilog Code for a full adder circuit.	(7)

****

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
			2	0	0	2
EST 200	DESIGN AND ENGINEERING					

Preamble:

The purpose of this course is to

i) introduce the undergraduate engineering studentsthe fundamental principles of design engineering,

ii) make them understand the steps involved in the design process and

iii) familiarize them with the basic tools used and approaches in design.

Students are expected to apply design thinking in learning as well as while practicing engineering, which is very important and relevant for today. Case studies from various practical situations will help the students realize that design is not only concerned about the function but also many other factors like customer requirements, economics, reliability, etc. along with a variety of life cycle issues.

The course will help students to consider aesthetics, ergonomics and sustainability factors in designs and also to practice professional ethics while designing.

Prerequisite:

Nil. The course will be generic to all engineering disciplines and will not require specialized preparation or prerequisites in any of the individual engineering disciplines.

Course Outcomes:

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

CO 1	Explain the different concepts and principles involved in design engineering.
CO 2	Apply design thinking while learning and practicing engineering.
CO 3	Develop innovative, reliable, sustainable and economically viable designs incorporating knowledge 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	2	1					1			1		
CO 2		2				1		1				2
CO 3			2			1	1		2	2		1

Assessment Pattern

Continuous Internal Evaluation (CIE) Pattern:

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

End Semester Examination (ESE) Pattern: There will be two parts; Part A and Part B.
Part A : 30 marks
part B : 70 marks
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 case study questions from each module of which student should answer any one. Each question carry 14 marks and can have maximum 2 sub questions.

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	5	5	10
Understand	10	10	20
Apply	35	35	70
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Course Level Assessment Questions

Course Outcome 1 (CO1): Appreciate the different concepts and principles involved in design engineering.

1. State how engineering design is different from other kinds of design

2. List the different stages in a design process.

3. Describedesign thinking.

4. State the function of prototyping and proofing in engineering design.

5. Write notes on the following concepts in connection with design engineering 1) Modular Design, 2) Life Cycle Design , 3) Value Engineering, 4) Concurrent Engineering, and 5) Reverse Engineering

6. State design rights.

Course Outcome 2 (CO2) Apply design thinking while learning and practicing engineering.

1. Construct the iterative process for design thinking in developing simple products like a pen, umbrella, bag, etc.

2. Show with an example how divergent-convergent thinking helps in generating alternative designs and then how to narrow down to the best design.

3. Describe how a problem-based learning helps in creating better design engineering solutions.

4. Discuss as an engineer, how ethics play a decisive role in your designs

Course Outcome 3(CO3): Develop innovative, reliable, sustainable and economically viable designs incorporating different segments of knowledge in engineering.

1. Illustratethe development of any simple product by passing through the different stages of design process

2. Show thegraphical design communication with the help of detailed 2D or 3D drawings for any simple product.

3. Describe how to develop new designs for simple products through bio-mimicry.

Model Question paper

Page 1 of 2

Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD/FOURTH SEMESTER B.TECH DEGREE EXAMINATION

Course Code: EST 200

Course Name: DESIGN AND ENGINEERING

Max. Marks: 100Duration: 3 Hours

PART A

Answer all questions, each question carries 3 marks
Use only hand sketches

(1)Write aboutthe basic design process.

(2) Describe how to finalize the design objectives.

(3) State the role of divergent-convergent questioning in design thinking.

(4) Discuss how to perform design thinking in a team managing the conflicts.

(5) Show how engineering sketches and drawings convey designs.

(6)Explain the role of mathematics and physics in design engineering process.

(7) Distinguish between project-based learning and problem-based learning in design engineering.

(8) Describe how concepts like value engineering , concurrent engineering and reverse engineering influence engineering designs?

(9) Show how designs are varied based on the aspects of production methods, life span, reliability and environment?

(10) Explain how economics influence the engineering designs?

(10x3 marks =30 marks)

Part B

Answer any ONE question from each module. Each question carry 14 marks

Module 1

(11) Show the designing of a wrist watch going through the various stages of the design process. Use hand sketches to illustrate the processes.

or

(12)Find the customer requirements for designing a new car showroom. Show how the design objectives were finalized considering the design constraints?

Module 2

(13)Illustrate the design thinking approach for designing a bag for college students within a limited budget. Describe each stage of the process and the iterative procedure involved. Use hand sketches to support your arguments.

or

(14)Construct a number of possible designs and then refine them to narrow down to the best design for a drug trolley used in hospitals. Show how the divergent-convergent thinking helps in the process. Provide your rationale for each step by using hand sketches only.

Module 3

(15) Graphically communicate the design of a thermo flask used to keep hot coffee. Draw the detailed 2D drawings of the same with design detailing, material selection, scale drawings, dimensions, tolerances, etc. Use only hand sketches.

or

(16)Describe the role of mathematical modelling in design engineering. Show how mathematics and physics play a role in designing a lifting mechanism to raise 100 kg of weight to a floor at a height of 10 meters in a construction site.

Module 4

(17) Show the development of a nature inspired design for a solar poweredbus waiting shed beside a highway. Relate between natural and man-made designs. Use hand sketches to support your arguments.

or

(18)Show the design of a simple sofa and then depict how the design changes when considering 1) aesthetics and 2) ergonomics into consideration. Give hand sketches and explanations to justify the changes in designs.

Module 5

(19)Examine the changes in the design of a foot wear with constraints of 1) production methods, 2) life span requirement, 3) reliability issues and 4) environmental factors. Use hand sketches and give proper rationalization for the changes in design.

or

(20)Describe the how to estimate the cost of a particular design using ANY of the following: i) a website, ii) the layout of a plant, iii) the elevation of a building, iv) anelectrical or electronic system or device and v) a car.

Show how economics will influence the engineering designs. Use hand sketches to support your arguments.

(5x14 marks =70 marks)

Syllabus

Module 1

Design Process:- Introduction to Design and Engineering Design, Defining a Design Process-:Detailing Customer Requirements, Setting Design Objectives, Identifying Constraints, Establishing Functions, Generating Design Alternatives and Choosing a Design.

Module 2

Design Thinking Approach:-Introduction to Design Thinking, Iterative Design Thinking Process Stages: Empathize, Define, Ideate, Prototype and Test. Design Thinking as Divergent-Convergent Questioning. Design Thinking in a Team Environment.

Module 3

Design Communication (Languages of Engineering Design):-Communicating Designs Graphically, Communicating Designs Orally and in Writing. Mathematical Modeling In Design, Prototyping and Proofing the Design.

Module 4

Design Engineering Concepts:-Project-based Learning and Problem-based Learning in Design.Modular Design and Life Cycle Design Approaches. Application of Bio-mimicry,Aesthetics and Ergonomics in Design. Value Engineering, Concurrent Engineering, and Reverse Engineering in Design.

Module 5

Expediency, Economics and Environment in Design Engineering:-Design for Production, Use, and Sustainability. Engineering Economics in Design. Design Rights. Ethics in Design

Text Books

1) YousefHaik, SangarappillaiSivaloganathan, Tamer M. Shahin, Engineering Design Process, Cengage Learning 2003, Third Edition, ISBN-10: 9781305253285,

2) Voland, G., Engineering by Design, Pearson India 2014, Second Edition, ISBN 9332535051

Reference Books

1.Philip Kosky, Robert Balmer, William Keat, George Wise, Exploring Engineering, Fourth Edition: An Introduction to Engineering and Design, Academic Press 2015, 4th Edition, ISBN: 9780128012420.

2. Clive L. Dym, Engineering Design: A Project-Based Introduction, John Wiley & Sons, New York 2009, Fourth Edition, ISBN: 978-1-118-32458-5

3. Nigel Cross, Design Thinking: Understanding How Designers Think and Work, Berg Publishers 2011, First Edition, ISBN: 978-1847886361

4. Pahl, G., Beitz, W., Feldhusen, J., Grote, K.-H., Engineering Design: A Systematic Approach, Springer 2007, Third Edition, ISBN 978-1-84628-319-2

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Module 1: Design Process**	
1.1	Introduction to Design and Engineering Design. *What does it mean to design something? How Is engineering design different from other kinds of design? Where and when do engineers design? What are the basic vocabularyin engineering design? How to learn and do engineering design.*	1
1.2	*Defining a Design Process*-: Detailing Customer Requirements. *How to do engineering design? Illustrate the process with an example. How to identify the customer requirements of design?*	1
1.3	*Defining a Design Process*-: Setting Design Objectives, Identifying Constraints, Establishing Functions. *How to finalize the design objectives? How to identify the design constraints? How to express the functions a design in engineering terms?*	1
1.4	*Defining a Design Process*-: Generating Design Alternatives and Choosing a Design. *How to generate or create feasible design alternatives? How to identify the "best possible design"?*	1
1.5	Case Studies:- Stages of Design Process. *Conduct exercises for designing simple products going through the different stages of design process.*	1
2	**Module 2: Design Thinking Approach**	
2.1	Introduction to Design Thinking *How does the design thinking approach help engineers in creating innovative and efficient designs?*	1
2.2	Iterative Design Thinking Process Stages: Empathize, Define, Ideate, Prototype and Test. *How can the engineers arrive at better designs utilizing the iterative design thinking process (in which knowledge acquired in the later stages can be applied back to the earlier stages)?*	1
2.3	Design Thinking as Divergent-Convergent Questioning. *Describe how to create a number of possible designs and then how to refine and narrow down to the 'best design'.*	1
2.4	Design Thinking in a Team Environment. *How to perform design thinking as a team managing the conflicts ?*	1
2.5	Case Studies: Design Thinking Approach. *Conduct exercises using the design thinking approach for*	1

	designing any simple products within a limited time and budget	
3	**Module 3: Design Communication (Languages of Engineering Design)**	
3.1	Communicating Designs Graphically. *How do engineering sketches and drawings convey designs?*	1
3.2	Communicating Designs Orally and in Writing. *How can a design be communicated through oral presentation or technical reports efficiently?*	1
	First Series Examination	
3.3	Mathematical Modelling in Design. *How do mathematics and physics become a part of the design process?*	1
3.4	Prototyping and Proofing the Design. *How to predict whether the design will function well or not?*	1
3.5	Case Studies: Communicating Designs Graphically. *Conduct exercises for design communication through detailed 2D or 3D drawings of simple products with design detailing, material selection, scale drawings, dimensions, tolerances, etc.*	1
4	**Module 4: Design Engineering Concepts**	
4.1	Project-based Learning and Problem-based Learning in Design. *How engineering students can learn design engineering through projects?* *How students can take up problems to learn design engineering?*	1
4.2	Modular Design and Life Cycle Design Approaches. *What is modular approach in design engineering? How it helps?* *How the life cycle design approach influences design decisions?*	1
4.3	Application of Bio-mimicry, Aesthetics and Ergonomics in Design. *How do aesthetics and ergonomics change engineering designs?* *How do the intelligence in nature inspire engineering designs? What are the common examples of bio-mimicry in engineering?*	1
4.4	Value Engineering, Concurrent Engineering, and Reverse Engineering in Design. *How do concepts like value engineering , concurrent engineering and reverse engineering influence engineering designs?*	1
4.5	Case Studies: Bio-mimicry based Designs. *Conduct exercises to develop new designs for simple*	1

	products using bio-mimicry and train students to bring out new nature inspired designs.	
5	**Module 5: Expediency, Economics and Environment in Design Engineering**	
5.1	Design for Production, Use, and Sustainability. *How designs are finalized based on the aspects of production methods, life span, reliability and environment?*	1
5.2	Engineering Economics in Design. *How to estimate the cost of a particular design and how will economics influence the engineering designs?*	1
5.3	Design Rights. *What are design rights and how can an engineer put it into practice?*	1
5.4	Ethics in Design. *How do ethics play a decisive role in engineering design?*	1
5.5	Case Studies: Design for Production, Use, and Sustainability. *Conduct exercises using simple products to show how designs change with constraints of production methods, life span requirement, reliability issues and environmental factors.*	1
Second Series Examination		

Code.	Course Name	L	T	P	Hrs	Credit
HUT 200	Professional Ethics	2	0	0	2	2

Preamble: To enable students to create awareness on ethics and human values.

Prerequisite: Nil

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

CO 1	Understand the core values that shape the ethical behaviour of a professional.
CO 2	Adopt a good character and follow an ethical life.
CO 3	Explain the role and responsibility in technological development by keeping personal ethics and legal ethics.
CO 4	Solve moral and ethical problems through exploration and assessment by established experiments.
CO 5	Apply the knowledge of human values and social values to contemporary ethical values and global issues.

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	PO10	PO11	PO12
CO 1								2			2	
CO 2								2			2	
CO 3								3			2	
CO 4								3			2	
CO 5								3			2	

Assessment Pattern

Bloom's category	Continuous Assessment Tests		End Semester Exam
	1	2	
Remember	15	15	30
Understood	20	20	40
Apply	15	15	30

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	:	10 marks
Continuous Assessment Tests (2 Nos)	:	25 marks
Assignments/Quiz	:	15 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 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. Define integrity and point out ethical values.
2. Describe the qualities required to live a peaceful life.
3. Explain the role of engineers in modern society.

Course Outcome 2 (CO2)
1. Derive the codes of ethics.
2. Differentiate consensus and controversy.
3. Discuss in detail about character and confidence.

Course Outcome 3(CO3):
1. Explain the role of professional's ethics in technological development.
2. Distinguish between self interest and conflicts of interest.
3. Review on industrial standards and legal ethics.

Course Outcome 4 (CO4):
1. Illustrate the role of engineers as experimenters.
2. Interpret the terms safety and risk.
3. Show how the occupational crimes are resolved by keeping the rights of employees.

Course Outcome 5 (CO5):
1. Exemplify the engineers as managers.
2. Investigate the causes and effects of acid rain with a case study.
3. Explorate the need of environmental ethics in technological development.

Model Question paper

QP CODE: **Reg No:**_____

PAGES:3 **Name :**_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY THIRD/FOURTH SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: HUT 200

Course Name: PROFESSIONAL ETHICS

Max. Marks: 100 **Duration: 3 Hours**

(2019-Scheme)

PART A

(Answer all questions, each question carries 3 marks)

1. Define empathy and honesty.
2. Briefly explain about morals, values and ethics.
3. Interpret the two forms of self-respect.
4. List out the models of professional roles.
5. Indicate the advantages of using standards.
6. Point out the conditions required to define a valid consent?
7. Identify the conflicts of interests with an example?
8. Recall confidentiality.
9. Conclude the features of biometric ethics.
10. Name any three professional societies and their role relevant to engineers.

(10x3 = 30 marks)

PART B

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

MODULE I

11. a) Classify the relationship between ethical values and law?

b) Compare between caring and sharing. (10+4 = 14 marks)

Or

12. a) Exemplify a comprehensive review about integrity and respect for others.

b) Discuss about co-operation and commitment. (8+6 = 14 marks)

MODULE II

13.a) Explain the three main levels of moral developments, deviced by Kohlberg.

b) Differentiate moral codes and optimal codes. (10+4 = 14 marks)

Or

14. a) Extrapolate the duty ethics and right ethics.

b) Discuss in detail the three types of inquiries in engineering ethics (8+6 = 14 marks)

MODULE III

15.**a)** Summarize the following features of morally responsible engineers.

(i) Moral autonomy **(ii)** Accountability

b)Explain the rights of employees (8+6 = 14 marks)

Or

16. a) Explain the reasons for Chernobyl mishap ?

b) Describe the methods to improve collegiality and loyalty. (8+6 = 14 marks)

MODULE IV

17.a) Execute collegiality with respect to commitment, respect and connectedness.

b) Identify conflicts of interests with an example. (8+6 = 14 marks)

Or

18. a) Explain in detail about professional rights and employee rights.

b) Exemplify engineers as managers.

MODULE V

19.**a)** Evaluate the technology transfer and appropriate technology.

b) Explain about computer and internet ethics. (8+6 = 14 marks)

Or

20. a) Investigate the causes and effects of acid rain with a case study.

b) Conclude the features of ecocentric and biocentric ethics. (8+6 = 14 marks)

Syllabus

Module 1 – Human Values.

Morals, values and Ethics – Integrity- Academic integrity-Work Ethics- Service Learning- Civic Virtue- Respect for others- Living peacefully- Caring and Sharing- Honestly- courage-Cooperation commitment- Empathy-Self Confidence -Social Expectations.

Module 2 - Engineering Ethics & Professionalism.

Senses of Engineering Ethics - Variety of moral issues- Types of inquiry- Moral dilemmas –Moral Autonomy – Kohlberg's theory- Gilligan's theory- Consensus and Controversy-Profession and Professionalism- Models of professional roles-Theories about right action –Self interest-Customs and Religion- Uses of Ethical Theories.

Module 3- Engineering as social Experimentation.

Engineering as Experimentation – Engineers as responsible Experimenters- Codes of Ethics- Plagiarism- A balanced outlook on law - Challenges case study- Bhopal gas tragedy.

Module 4- Responsibilities and Rights.

Collegiality and loyalty – Managing conflict- Respect for authority- Collective bargaining- Confidentiality- Role of confidentiality in moral integrity-Conflicts of interest- Occupational crime- Professional rights- Employee right- IPR Discrimination.

Module 5- Global Ethical Issues.

Multinational Corporations- Environmental Ethics- Business Ethics- Computer Ethics -Role in Technological Development-Engineers as Managers- Consulting Engineers- Engineers as Expert witnesses and advisors-Moral leadership.

Text Book

1. M Govindarajan, S Natarajan and V S Senthil Kumar, Engineering Ethics, PHI Learning Private Ltd, New Delhi,2012.
2. R S Naagarazan, A text book on professional ethics and human values, New age international (P) limited ,New Delhi,2006.

Reference Books

1. Mike W Martin and Roland Schinzinger, Ethics in Engineering,4th edition, Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi,2014.
2. Charles D Fleddermann, Engineering Ethics, Pearson Education/ Prentice Hall of India, New Jersey,2004.
3. Charles E Harris, Michael S Protchard and Michael J Rabins, Engineering Ethics- Concepts and cases, Wadsworth Thompson Learning, United states,2005.
4. http://www.slideword.org/slidestag.aspx/human-values-and-Professional-ethics.

Course Contents and Lecture Schedule

SL.No	Topic	No. of Lectures 25
1	**Module 1 – Human Values.**	
1.1	Morals, values and Ethics, Integrity, Academic Integrity,Work Ethics	1
1.2	Service Learning, Civic Virtue, Respect for others, Living peacefully	1
1.3	Caring and Sharing, Honesty, Courage, Co-operation commitment	2
1.4	Empathy, Self Confidence, Social Expectations	1
2	**Module 2- Engineering Ethics & Professionalism.**	
2.1	Senses of Engineering Ethics, Variety of moral issues, Types of inquiry	1
2.2	Moral dilemmas, Moral Autonomy, Kohlberg's theory	1
2.3	Gilligan's theory, Consensus and Controversy,Profession& Professionalism, Models of professional roles, Theories about right action	2
2.4	Self interest-Customs and Religion, Uses of Ethical Theories	1
3	**Module 3- Engineering as social Experimentation.**	
3.1	Engineering as Experimentation, Engineers as responsible Experimenters	1
3.2	Codes of Ethics,Plagiarism, A balanced outlook on law	2
3.3	Challenger case study, Bhopal gas tragedy	2
4	**Module 4- Responsibilities and Rights.**	
4.1	Collegiality and loyalty, Managing conflict, Respect for authority	1
4.2	Collective bargaining, Confidentiality, Role of confidentiality in moral integrity, Conflicts of interest	2
4.3	Occupational crime, Professional rights, Employee right, IPR Discrimination	2
5	**Module 5- Global Ethical Issues.**	
5.1	Multinational Corporations, Environmental Ethics, Business Ethics, Computer Ethics	2
5.2	Role in Technological Development, Moral leadership	1
5.3	Engineers as Managers, Consulting Engineers, Engineers as Expert witnesses and advisors	2

CODE		CATEGORY	L	T	P	CREDIT
MCN201	SUSTAINABLE ENGINEERING		2	0	0	NIL

Preamble: Objective of this course is to inculcate in students an awareness of environmental issues and the global initiatives towards attaining sustainability. The student should realize the potential of technology in bringing in sustainable practices.

Prerequisite: NIL

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

CO 1	Understand the relevance and the concept of sustainability and the global initiatives in this direction
CO 2	Explain the different types of environmental pollution problems and their sustainable solutions
CO 3	Discuss the environmental regulations and standards
CO 4	Outline the concepts related to conventional and non-conventional energy
CO 5	Demonstrate the broad perspective of sustainable practices by utilizing engineering knowledge and principles

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						2	3					2
CO 2						2	3					2
CO 3						2	3					2
CO 4						2	3					2
CO 5						2	3					2

Assessment Pattern

Mark distribution

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

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.

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Course Level Assessment Questions

Course Outcome 1 (CO1): Understand the relevance and the concept of sustainability and the global initiatives in this direction

1. Explain with an example a technology that has contributed positively to sustainable development.
2. Write a note on Millennium Development Goals.

Course Outcome 2 (CO2): Explain the different types of environmental pollution problems and their sustainable solutions

1. Explain the 3R concept in solid waste management?
2. Write a note on any one environmental pollution problem and suggest a sustainable solution.
3. In the absence of green house effect the surface temperature of earth would not have been suitable for survival of life on earth. Comment on this statement.

Course Outcome 3(CO3): Discuss the environmental regulations and standards

1. Illustrate Life Cycle Analysis with an example of your choice.
2. "Nature is the most successful designer and the most brilliant engineer that has ever evolved". Discuss.

Course Outcome 4 (CO4): Outline the concepts related to conventional and non-conventional energy

1. Suggest a sustainable system to generate hot water in a residential building in tropical climate.
2. Enumerate the impacts of biomass energy on the environment.

Course Outcome 5 (CO5): Demonstrate the broad perspective of sustainable practices by utilizing engineering knowledge and principles

1. Suggest suitable measures to make the conveyance facilities used by your institution sustainable.

Model Question paper

Part A

(Answer all questions. Each question carries 3 marks each)

1. Define sustainable development.
2. Write a short note on Millennium Development Goals.
3. Describe carbon credit.
4. Give an account of climate change and its effect on environment.
5. Describe biomimicry? Give two examples.
6. Explain the basic concept of Life Cycle Assessment.
7. Name three renewable energy sources.

8. Mention some of the disadvantages of wind energy.
9. Enlist some of the features of sustainable habitat.
10. Explain green engineering.

Part B

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

11. Discuss the evolution of the concept of sustainability. Comment on its relevance in the modern world.

OR

12. Explain Clean Development Mechanism.
13. Explain the common sources of water pollution and its harmful effects.

OR

14. Give an account of solid waste management in cities.
15. Explain the different steps involved in the conduct of Environmental Impact Assessment.

OR

16. Suggest some methods to create public awareness on environmental issues.
17. Comment on the statement, “Almost all energy that man uses comes from the Sun”.

OR

18. Write notes on:
    a. Land degradation due to water logging.
    b. Over exploitation of water.
19. Discuss the elements related to sustainable urbanisation.

OR

20. Discuss any three methods by which you can increase energy efficiency in buildings.

Syllabus

Sustainability- need and concept, technology and sustainable development-Natural resources and their pollution, Carbon credits, Zero waste concept. Life Cycle Analysis, Environmental Impact Assessment studies, Sustainable habitat, Green buildings, green materials, Energy, Conventional and renewable sources, Sustainable urbanization, Industrial Ecology.

Module 1

Sustainability: Introduction, concept, evolution of the concept; Social, environmental and economic sustainability concepts; Sustainable development, Nexus between Technology and Sustainable development; Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs), Clean Development Mechanism (CDM).

Module 2

Environmental Pollution: Air Pollution and its effects, Water pollution and its sources, Zero waste concept and 3 R concepts in solid waste management; Greenhouse effect, Global warming, Climate change, Ozone layer depletion, Carbon credits, carbon trading and carbon foot print, legal provisions for environmental protection.

Module 3

Environmental management standards: ISO 14001:2015 frame work and benefits, Scope and goal of Life Cycle Analysis (LCA), Circular economy, Bio-mimicking, Environment Impact Assessment (EIA), Industrial ecology and industrial symbiosis.

Module 4

Resources and its utilisation: Basic concepts of Conventional and non-conventional energy, General idea about solar energy, Fuel cells, Wind energy, Small hydro plants, bio-fuels, Energy derived from oceans and Geothermal energy.

Module 5

Sustainability practices: Basic concept of sustainable habitat, Methods for increasing energy efficiency in buildings, Green Engineering, Sustainable Urbanisation, Sustainable cities, Sustainable transport.

Reference Books

1. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.
2. Bradley. A.S; Adebayo,A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning
3. Environment Impact Assessment Guidelines, Notification of Government of India, 2006
4. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998
5. ECBC Code 2007, Bureau of Energy Efficiency, New Delhi Bureau of Energy Efficiency Publications-Rating System, TERI Publications - GRIHA Rating System
6. Ni bin Chang, Systems Analysis for Sustainable Engineering: Theory and Applications, McGraw-Hill Professional.
7. Twidell, J. W. and Weir, A. D., Renewable Energy Resources, English Language Book Society (ELBS).
8. Purohit, S. S., Green Technology - An approach for sustainable environment, Agrobios Publication

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	Sustainability	
1.1	Introduction, concept, evolution of the concept	1
1.2	Social, environmental and economic sustainability concepts	1
1.3	Sustainable development, Nexus between Technology and Sustainable development	1
1.4	Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs)	1
1.5	Clean Development Mechanism (CDM)	1
2	Environmental Pollution	
2.1	Air Pollution and its effects	1
2.2	Water pollution and its sources	1
2.3	Zero waste concept and 3 R concepts in solid waste management	1
2.4	Greenhouse effect, Global warming, Climate change, Ozone layer depletion	1
2.5	Carbon credits, carbon trading and carbon foot print.	1
2.6	Legal provisions for environmental protection.	1
3	Environmental management standards	
3.1	Environmental management standards	1
3.2	ISO 14001:2015 frame work and benefits	1
3.3	Scope and Goal of Life Cycle Analysis (LCA)	1
3.4	Circular economy, Bio-mimicking	1
3.5	Environment Impact Assessment (EIA)	1
3.6	Industrial Ecology, Industrial Symbiosis	1
4	Resources and its utilisation	
4.1	Basic concepts of Conventional and non-conventional energy	1
4.2	General idea about solar energy, Fuel cells	1
4.3	Wind energy, Small hydro plants, bio-fuels	1
4.4	Energy derived from oceans and Geothermal energy	1
5	Sustainability Practices	
5.1	Basic concept of sustainable habitat	1
5.2	Methods for increasing energy efficiency of buildings	1
5.3	Green Engineering	1
5.4	Sustainable Urbanisation, Sustainable cities, Sustainable transport	1

RAL 201	MACHINE DRAWING AND SOLID MODELLING LAB	CATEGORY	L	T	P	CREDIT
		PCC	0	0	3	2

CO1	Understand the basic principles of machine drawing as per standards and to get familiar with the different schemes of dimensioning, providing symbols with simple machine parts drawings.
CO2	Understand and get familiar to specifying limits, fits, dimensional and geometric tolerances and surface roughness in machine drawings
CO3	Get familiar to assembly drawing practices and prepare assembly drawings of robotic components.
CO4	Get hands on using CAD software for preparing 2D drawings and 3D models of parts and to export them to various formats for different applications.
CO5	Get hands on preparing the assemblies of various machine parts using cad models and using them for various analysis purposes.

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
CO 2	3											3
CO 3	3				3							3
CO 4	3	2			3							3
CO 5	3	2			3							3

Assessment Pattern

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	75	75	2.5 hours

Continuous Internal Evaluation Pattern:

Attendance : 15 marks
Continuous Assessment : 30 marks
Internal Test*: 30 marks

*First internal evaluation must be based on the first three modules (manual drawing)

*The second internal evaluation is to be done with a mini project, incorporating the CAD of a mechanical assembly, initially creating 2D drawings of the assembly and then designing the parts in 3D modelling and generating 2D from the 3D assembly and comparing with the initial 2D drawings.

End Semester Examination Pattern: This will be based on modules III-V. The following guidelines should be followed regarding award of marks

(a) Completion of parts- 25 marks

(b)Assembly of parts-15 marks

(c) Development of 2D drawing (Annotations, bill of materials, dimensions)-30 marks

(d) Record (File of all manual drawings and CAD print outs)- 5marks

Module	Contents
I	Introduction Principles of drawing: - Free hand sketching, manual drawing, CAD drawing etc. Code of practice for Engineering Drawing: -BIS specifications – lines, types of lines, dimensioning, sectional views,Welding symbols, riveted joints, keys, fasteners –bolts, nuts, screws, keys.
II	Limits, Fits – Tolerances of individual dimensions – Specification of Fits – basic principles of geometric & dimensional tolerances. surface roughness, indication of surface roughness etc.
III	Preparation of production drawings and reading of part and assembly drawings, Exercises on Fasteners, Couplings- Oldham's coupling, flexible couplings, universal joints.
IV	Introduction, input, output devices, introduction to drafting software like Auto CAD, basic commands and development of simple 2D and 3D drawings, Different file formats for 3D modelling(IGES, STL etc.) Drawing, Editing, Dimensioning,Plotting Commands, Layering Concepts, Matching, Detailing, Detailed drawings.
V	Exercises on 3D solid modelling: -Plummer block, bearings, guideways, generating 2D from 3D, assembly drawing of mechanical engineering parts. Exercises on valves, couplings, gears and gear trains, belts, pulleys, modelling of robot grippers. Incorporating electronic components in CAD models.

RAL 203	ELECTRONIC CIRCUITS AND DIGITAL ELECTRONICS LABORATORY	CATEGORY	L	T	P	CREDIT
		PCC	0	0	3	2

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

CO 1	Design and develop various wave shaping circuits, amplifiers and oscillators using discrete components
CO 2	Design and test various circuits using opamps
CO 3	Design and test various combinational and sequential logic circuits
CO 4	Design PCBs
CO 5	Program basic combinational circuits using Verilog

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	2	2		2			2	2		3
CO 2	3	2	2	2		2			2	2		3
CO 3	3	2	2	2		2			2	2		3
CO 4	3	2	2	2		2			2	2		3
CO 5	3	2	2	2	2	2			2	2		3
CO 6	3	2	2	2	2	2			2	2		3

Assessment Pattern

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	75	75	2.5 hours

Continuous Internal Evaluation Pattern:

Attendance : 15 marks
Continuous Assessment : 30 marks
Internal Test (Immediately before the second series test) : 30 marks

End Semester Examination Pattern: The following guidelines should be followed regarding award of marks

(a) Preliminary work : 15 Marks
(b) Implementing the work/Conducting the experiment : 10 Marks
(c) Performance, result and inference (usage of equipments and trouble shooting) : 25 Marks
(d) Viva voce : 20 Marks
(e) Record : 5 Marks

LIST OF EXPERIMENTS

Any 5 experiments each from Part A and Part B. Part C is compulsory

Part A: Electronic Circuits

1. Clipping and clamping circuits using diodes
2. RC coupled amplifier using BJT in CE configuration- Measurement of gain, input and output impedance and frequency response
3. JFET amplifier- Measurement of voltage gain, current gain, input and output impedance
4. RC phase shift oscillator using BJT and OPAMPS
5. OPAMP circuits – Design and set up of inverting and non-inverting amplifier, scale changer, adder, integrator, differentiator
6. Comparator and Schmitt Trigger using OPAMPs
7. Astable and monostable circuit using IC 555
8. Design and testing of zener voltage regulators

Part B: Digital Electronics

1. Realisation of SOP & POS functions after K map reduction
2. Half adder and Full adder realization using NAND gates
3. 4-bit adder/subtractor using IC 7483
4. BCD to decimal decoder and BCD to 7-segment decoder and display
5. Study of multiplexer IC and realization of combinational circuits using multiplexers
6. Study of counter ICs (7490, 7493)
7. Design of synchronous up, down and modulo N counters
8. Study of shift register IC 7495, Ring counter and Johnson counter

PART C: Part C is compulsory

1. Introduction to PCB layout software
2. Verilog implementation of full adder, 4 bit magnitude comparator

Reference Books

1. Robert L. Boylestad and Louis Nashelsky, “Electronic Devices and Circuit Theory”, Pearson Education India, 11/e, 2013
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