

S2 - MECHANICAL QUESTION BANK 2025

Questions compiled by

DEPARTMENT OF MECHANICAL ENGINEERING
VIDYA ACADEMY OF SCIENCE AND TECHNOLOGY TECHNICAL
CAMPUS, KILIMANOOR, THIRUVANATHAPURAM

QUESTION BANK

Second Semester

GYMAT201: MATHEMATICS FOR ELECTRICAL SCIENCE AND PHYSICAL SCIENCE 2

Module 1			
Sl. No	Questions	Marks	KU/KTU
1	(a) Given $f = e^x \sin y + e^y \cos x$, show that the function satisfies the Laplace equation $f_{xx} + f_{yy} = 0$ (b) Show that the equation $u(x, t) = \sin(x - ct)$, satisfies wave equation $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$	3+3	KTU Apr 2018 Dec 2021 Dec 2022
2	Let $w = 4x^2 + 4y^2 + z^2$, where $x = \rho \sin\phi \cos\theta$, $y = \rho \sin\phi \sin\theta$, $z = \rho \cos\phi$. Find $\frac{\partial w}{\partial \rho}$, $\frac{\partial w}{\partial \phi}$, $\frac{\partial w}{\partial \theta}$ using chain rule.	7	KTU Apr 2018 Dec 2021 Dec 2022
3	Locate all relative extrema and saddle points of the function $f(x, y) = 2xy - x^3 - y^2$	7	KTU Apr 2018 Dec 2019 Dec 2022
4	(a) The radius and height of a right circular cone are measured with errors of at most 1% and 4% respectively. Use differentials to approximate the maximum percentage error in the calculated volume. (b) The length and width of a rectangle are measured with errors of at most $r\%$, where r is small. Use differentials to approximate the maximum percentage error in the calculated length of the diagonal.	7+7	KTU Dec 2019 Sept. 2021 Dec 2022
5	(a) Find the local linear approximation L to the function $f(x, y) = \sqrt{x^2 + y^2}$ at the point P(3, 4). Compare the error in approximating f by L at the point Q (3.04, 3.98) with distance PQ. (b) Find the local linear approximation L of $f(x, y, z) = xyz$ at the point P(1,2,3). Compute the error in approximation f by L at the point Q(1.001, 2.002, 3.003).	7+7	KTU Dec 2019 Sept. 2021 Dec 2022

6	<p>(a) Let , $w = f(P, Q, R)$ where $P = \frac{x}{y}$, $Q = \frac{y}{z}$, $R = \frac{z}{x}$ prove that</p> $x \frac{\partial w}{\partial x} + y \frac{\partial w}{\partial y} + z \frac{\partial w}{\partial z} = 0$ <p>(b) Let f be a differentiable function of three variables and suppose that $w = f(x - y, y - z, z - x)$, show that</p> $\frac{\partial w}{\partial x} + \frac{\partial w}{\partial y} + \frac{\partial w}{\partial z} = 0$	7	KTU Dec 2019 Sept. 2021 Dec 2022
7.	<p>(a) If $f(x, y) = xe^y + 5y$. Find the slope of $f(x, y)$ in the x-direction at (4,0).</p> <p>(b) Find the slope of the surface $z = \sqrt{x^2 + 4y^2}$ in the x-direction at the point (1,-2) and y-direction at (3,2).</p>	3+3	KTU Dec 2019 Sept. 2021 Dec 2022
8	Locate all relative maxima, relative minima and saddle point of $f(x, y) = x^4y^2(12 - x - y)$.	7	KTU Dec 2019 Dec 2022
9	Given the function $W = xy + z$. Use chain rule to find the instantaneous rate of change of W at each point along the curve $x = \cos t$, $y = \sin t$, $z = t$.	3	KTU Apr 2018
10	Find $f_x(1,3)$ and $f_y(1,3)$ for the function $f(x, y) = 2x^3y^2 + 2y + 4x$.	3	KTU Apr 2018 Dec 2019 Sept 2021
Module 2			
1	<p>(a) Find the mass of the square lamina with vertices (0, 0), (1, 0), (1, 1) and (0, 1) and density function x^2y.</p> <p>(b) Find the Mass of the lamina with density $\delta(x, y) = x + 2y$ is bounded by the x-axis, the line $x = 1$ and the curve $y^2 = x$.</p> <p>(c) Find the mass and center of gravity of the lamina in the first quadrant bounded by the circle $x^2+y^2 = 1$ and the coordinate planes with density function xy.</p>	3+3+7	KTU Apr 2018 Dec 2019 Dec 2021 Dec 2022
2	Evaluate $\int_{-2}^2 \int_{-\sqrt{4-y^2}}^{\sqrt{4-y^2}} e^{-(x^2+y^2)} dx dy$ by changing to polar coordinates.	7	KTU Apr 2018 Dec 2019

			Dec 2021
3	Find the area bounded by the parabolas $y^2 = 4x$ and $x^2 = \frac{y}{2}$	7	KTU Apr 2018 Dec 2019 Dec 2021
4	(a) Change the order of integration and hence evaluate $\int_0^1 \int_{x^2}^{2-x} dy dx$ (b) Evaluate $\int_0^1 \int_y^1 \frac{x}{x^2+y^2} dx dy$ by reversing the order of integration.	7	KTU Dec 2020 Dec 2021 Dec 2022
5	Find the volume bounded by the cylinder $x^2+y^2 = 9$ and the planes $y+z = 3$ and $z = 0$.	7	KTU Dec 2020 Dec 2021 Dec 2022
6	(a) Evaluate $\int_1^a \int_1^b x^2 y dx dy$ (b) Evaluate $\int_0^3 \int_0^2 \int_0^1 xyz dx dy dz$	3+3	KTU Dec 2020 Dec 2021 Dec 2022
7	Use double integral to find the area of the plane region enclosed by the curves $y = \sin x$ and $y = \cos x$ for $0 \leq x \leq \frac{\pi}{4}$.	3	KTU Dec 2020 Dec 2021
8	Evaluate $\int \int_R \frac{\sin y}{y} dA$, where R is the triangular region bounded by the y-axis, $y = x$ and $y = \pi$.	7	KTU Dec 2020 Dec 2021
9	Use triple integral to find the volume of the solid within the cylinder $x^2 + y^2 = 9$ and between the planes $z = 1$ and $x + z = 5$.	7	KTU Dec 2020 Dec 2021
10	By converting into polar coordinates evaluate $\int_{-1}^1 \int_0^{\sqrt{1-x^2}} (x^2 + y^2)^{\frac{3}{2}} dy dx$	7	KTU Dec 2022
Module 3			
1	If $f(x, y, z) = x^2i - 3j + yz^2k$ find $\text{div } F$	2	KTU Apr-2018

2	Find the divergence and curl of the vector field $f(x, y, z) = yz\vec{i} + xy^2\vec{j} + yz^2\vec{k}$	2	KTU Apr-2018 & Dec-2017
3	Evaluate $\int_C (3x^2 + y^2) dx + 2xydy$ along the circular arc C given by $x = \cos t$, $y = \sin t$ for $0 \leq t \leq \frac{\pi}{2}$	3	KTU Dec-2017
4	Show that the integral $\int_{(1,1)}^{(3,3)} (e^x \log y - \frac{e^y}{x}) dx + (\frac{e^x}{y} - e^y \log x) dy$ where x and y are positive, is independent of path and find its value.	5	KTU Dec-2017
5	If $\vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$ and $r = \vec{r} $, then show that $\nabla f(r) = \frac{f'(r)}{r} \vec{r}$.	5	KTU Dec-2017
6	Find the directional derivative of $f(x, y) = x^2 + 3xy + y^2$ at the point P(2,1) in the direction of $\vec{a} = \frac{1}{3}\vec{i} + \frac{2}{3}\vec{j}$	3	KTU-June 2022
7	Show that $f(x, y) = (\cos y + y \cos x)\vec{i} + (\sin x - x \sin y)\vec{j}$ is a conservative vector field. Hence find the scalar potential for it.	5	KTU Dec-2017
8	Find the work done by the force field $F(x, y, z) = xy\vec{i} + yz\vec{j} + xz\vec{k}$ along C where C is the curve $r(t) = t\vec{i} + t^2\vec{j} + t^3\vec{k}$	7	KTU April 2018
9	(a) Find the parametric equation of the tangent to the curve $\vec{r}(t) = 2\cos\pi t\vec{i} + 2\sin\pi t\vec{j} + 6t\vec{k} \text{ at } t = \frac{1}{3}$ (c) Show that the vector field $\vec{f}(x, y) = 2xy^3\vec{i} + 3y^2x^2\vec{j}$ is conservative and find ϕ such that $\vec{f} = \nabla\phi$. Hence evaluate $\int_{(2,-2)}^{(-2,0)} 2xy^3 dx + 3y^2x^2 dy$	7+7	KTU-June 2022
10	(a) Find the position and velocity vectors of the particle, given $\vec{a}(t) = (t + 1)^{-2}\vec{j} + e^{-2t}\vec{k}, \vec{v}(0) = 3\vec{i} - \vec{j}, \vec{r}(0) = \vec{k}$	7	KTU-June 2022

Module 4			
1	Using Greens theorem, find the work done by the force field $\vec{f}(x, y) = (e^x - y^3)\vec{i} + (\cos y + x^3)\vec{j}$ on a particle that travels once around the unit circle $x^2 + y^2 = 1$ in the counter clockwise direction	5	KTU Apr-2018
2	If σ is any closed surface enclosing a volume V and $F = x\vec{i} + 2y\vec{j} + 3z\vec{k}$, using divergence theorem show that $\iint_{\sigma} F \cdot nds = 6V$.	3	KTU Apr-2018
3	Using line integral evaluate the area enclosed by the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$	2	KTU Dec-2017
4	Evaluate $\int_C (x^2 - 3y)dx + 3xdy$, where C is the circle $x^2 + y^2 = 4$	3	KTU Dec-2017
5	Using Stokes theorem evaluate $\int_C f \cdot dr$ where $F = xz\vec{i} + 4x^2y^2\vec{j} + xy\vec{k}$, C is the rectangle $0 \leq x \leq 1, 0 \leq y \leq 3$ in the plane $z = y$.	5	KTU DEC-2017
6	Using Divergence theorem evaluate $\iint_S F \cdot nds$ where $F = (x^2 + y)\vec{i} + z^2\vec{j} + (e^y - z)\vec{k}$ and S is the surface of the rectangular solid bounded by the co-ordinate planes $x = 3, y = 1, z = 3$	5	KTU Apr-2018
7	Find the circulation of $F = (x - z)\vec{i} + (y - x)\vec{j} + (z - xy)\vec{k}$ using Stokes theorem around the triangle with the vertices $A(1,0,0)$, $B(0,1,0)$ and $C(0,0,1)$.	7	KTU Dec 2017
8	Use Divergence theorem to find the outward flux of the vector field $F = 2x\vec{i} + 3y\vec{j} + z^3\vec{k}$ across the unit cube bounded by $x = 0, y = 0, z = 0, x = 1, y = 1, z = 1$	7	KTU June 2022
9	Determine whether the vector fields are free of sources and sinks, if it is not locate them. (i) $(y + z)\vec{i} - xz^3\vec{j} + x^2\sin y\vec{k}$ (ii) $xy\vec{i} - 2xy\vec{j} + y^2\vec{k}$.	5	KTU Dec-2017
10	(a) Use Green's theorem to find the work done by the force field	7+7	KTU-June 2022

$\vec{f}(x, y) = xy\vec{i} + \left(\frac{x^2}{2} + xy\right)\vec{j}$ on a particle that starts at (4,0)

transverse the upper semicircle $x^2 + y^2 = 16$ and returns to the starting point along X axis.

(b) Find the mass of the lamina that is the portion of the cone

$z = \sqrt{x^2 + y^2}$ that lies between the planes $z = 1$ and $z = 3$, if the density is $\phi(x, y, z) = x^2z$.

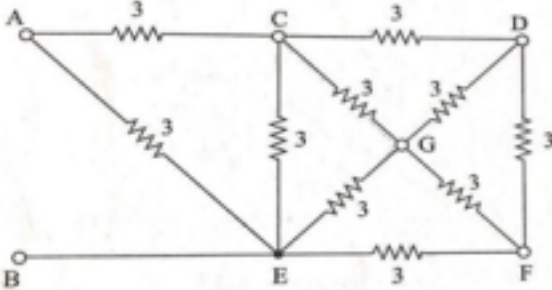
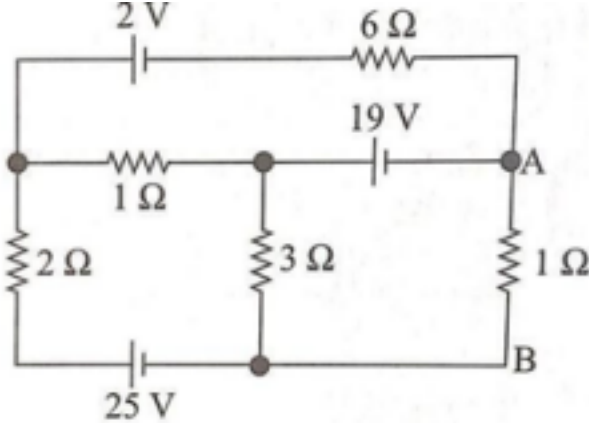
CODE: GCEST 203	COURSE NAME: ENGINEERING GRAPHICS AND COMPUTER AIDED DRAWING	L:T:P:R 2-0-2-0	Credit: 3
Qn. No.	Module-1	Marks	Year
1	One end of a line CD is 15 mm above HP and 20 mm in front of VP. At the same time the other end is 60 mm above HP and 50 mm in front of the VP. The distance between the end projectors is 70 mm. Draw the projections of the line and locate the traces. Determine the true and apparent lengths. Also find the true and apparent inclinations.	20	KTU-Jan 2024
2	The top view of a line AB is 70 mm long and is inclined at 45 degrees to XY line. One end of the line is 22 mm above HP and 12 mm in front of VP. The other end of the line is 60 mm above HP and is in front of VP. Find the true length, elevation length and true inclinations of the line with HP and VP. Show the locations of the traces of the line.	20	KTU-Jan 2024
3	One end point of a line AB is 12 mm above HP and is 15 mm in-front of VP. Other end point is 50 mm above HP and is 42 mm in front of VP. Draw the projections of the line AB if its elevation measures 70 mm. Find out its true length and the true inclinations with respect to the reference planes.	20	KTU-June 2022
4	One end point P of a line PQ, 75 mm long, is 10 mm above HP and 20 mm in front of VP. The line is inclined 45° to HP and its plan is inclined 35° to x-y line. Draw the projections of the line PQ and find out true inclination of the line with respect to VP.	20	KTU-June 2022
5	Distance between end projectors of a line CD is 65mm. End C is 15mm above HP and 40mm in front of VP. Its front view and top view makes an angle of 40° and 45° respectively with XY- line. Draw the projections, find true length and true inclinations with HP and VP and locate its traces. The line is in the first quadrant.	20	KTU-June 2023
6	The front view of a line AB measures 70mm and makes an angle of 50° with XY-line. The end A is in the HP and the VT of the line is 30mm above HP. The line is inclined at 40° to the VP. Draw the projections of the line, find its true length and true inclination to HP and locate its HT.	20	KTU-June 2023
7	A line AB of length 75 mm has one of its ends 60 mm in front of VP and 20 mm above HP. The other end is 20 mm in front of VP and is above HP. The top view of the line is 55 mm long. Draw its projections and also locate its traces.	20	KTU-June 2024
8	A line of length 60 mm has its end P is 15 mm above HP and 20 mm in front of VP. Its top view and front view measures 50 mm and 40 mm respectively. Draw its projections and determine its true inclinations with HP and VP. Also locate its traces.	20	KTU-June 2024
9	One end of line AB is 10 mm above HP and other end is 70 mm in front of VP. It's FV is 20 degrees inclined to xy while it's HT & VT are 10 mm and 5 mm below xy respectively. Draw projections and find TL with its inclinations with HP & VP.	20	KTU-May 2024
10	The end A of a line AB (True length 100mm) is 10 mm above HP and 20 mm in front of VP. The line AB is inclined at 30 degrees to the HP and 20 degrees to VP. Draw the projections of the line if the end B is in third quadrant and mark its traces.	20	KTU-May 2024
Qn. No.	Module- 2	Marks	Year
1	A cone of base 50 mm diameter and axis 75 mm long has one of its generators on the HP. A plane containing that generator and the axis is perpendicular to the HP and is inclined at 60° to the VP. Draw the projections of the cone when the base is nearer to the VP than the apex.	20	KTU-Dec 2023
2	A pentagonal pyramid, base 30 mm side and height 80mm has a triangular face on the ground and the vertical plane containing the axis make an angle of 30° with VP. Draw the projections of the solid.	20	KTU-Dec 2023
3	A hexagonal prism of base edge 25 mm and height 60 mm is resting on one of its base edges on HP. Draw its projection if the rectangular face carrying that base edge is inclined 35° to HP and the base edge at which it is resting is inclined 40° to VP	20	KTU-June 2023
4	Draw the projections of a triangular pyramid 35mm side and height 65 mm long, if it is resting on one of the corners of the base in HP with the slant edge containing that base corner making an angle of 30° with HP and top view of the axis making an angle of 45° with XY- line.	20	KTU-June 2023
5	A square pyramid of base side 30 mm and 60 mm long axis is freely suspended from one of the corners of its base. If the top view of the axis is 50 degrees inclined to XY line, draw the projections of the suspended solid. Make apex nearer to VP and right side of the viewer.	20	KTU-Jan 2024
6	A triangular prism of base edge 30 mm and height 50 mm is resting on one of its base edges on HP and that base edge is inclined 40 degrees to VP. Draw the projections of the solid if the axis is inclined at 40 degrees to HP. Top end face of the solid is away from VP and right side of the viewer.	20	KTU-Jan 2024

7	A square prism of base edge 30 mm and axis length 60 mm is resting on HP on one of its base edges such that the rectangular face containing the resting edge makes an angle of 40° with the HP. Draw its projections if the top view of the axis makes 30° with the VP.	20	KTU-June 2024
8	A tetrahedron of edge 35 mm is lying on the HP on one of its edges, such that the triangular face containing the resting edge is inclined at 30° to the HP and the resting edge is inclined at 50° to the VP. Draw its projection.	20	KTU-June 2024
9	A square prism of base 30 mm and length 60 mm has a base edge on VP, axis inclined at 30 degrees to VP and resting base edge is inclined at 40 degree to HP. Draw the projection of the solid.	20	KTU-May 2024
10	Draw projections of a cone of base diameter 50 mm and height 50 mm resting on HP on its generator with top view of axis inclined 30 degree to VP.	20	KTU-May 2024
Qn. No.	Module- 3	Marks	Year
1	A square prism of base side 30mm and height 75 mm rests on the HP on its base with two of its rectangular faces equally inclined to VP. It is cut by a plane perpendicular to VP and inclined at 60° to HP meeting the axis at 15 mm from top. Draw its elevation, sectional plan and true shape of section.	20	KTU-Dec 2023
2	Draw the development of the lateral surfaces of the hexagonal pyramid of base of side 25 mm and altitude 60 mm which is resting vertically on its base on the ground with two of the sides of the base perpendicular to the VP.	20	KTU-Dec 2023
3	A pentagonal pyramid side of base 30 mm, height 65 mm has its base on the ground and one of its base edge is parallel to and nearer to VP. This pyramid is cut by a section plane perpendicular to VP, passing through a point on the axis which is 20 mm below the apex and making an angle of 40° with HP. Draw the front view, sectional top view and true shape of the section.	20	KTU-June 2023
4	A square prism is resting on its base on HP with two base edges equally inclined to VP. A cutting plane perpendicular to VP and inclined 45° to HP cuts the solid meeting the axis 15 mm above the bottom base. Draw the development of the bottom portion. The base edge of the prism is 30 mm, and the height is 60 mm	20	KTU-June 2023
5	A pentagonal pyramid of base edge 30 mm and height 70 mm is resting on HP with one of the base edges perpendicular to VP and that base edge is situated left side of the viewer. It is cut by a section plane inclined towards right at 35 degrees to HP and it meet the axis of the solid at a distance 25 mm from the apex. Draw the front view, sectional top view, and true shape of the section.	20	KTU-Jan 2024
6	A right circular cylinder of 48 mm diameter and 62 mm height is cut by a section plane bisecting the axis inclined to left at 40 degrees to HP. Draw the development of the lateral surface of the truncated solid by considering the section plane perpendicular to VP. Also assume that cylinder is resting on its base on HP.	20	KTU-Jan 2024
7	A cone of base diameter 50 mm and axis length 70 mm rests with its base on HP. A section plane perpendicular to VP and inclined at 35° to HP and bisects the axis of the cone. Draw the development of the truncated cone.	20	KTU-June 2024
8	A hexagonal pyramid of base edge 30 mm and axis length 70 mm is resting on HP on its base. Two of its base edges are parallel to VP while it is resting. It is cut by a section plane perpendicular to VP and inclined at 45° to HP and passing through a point 15 mm above the base and is located on the axis. Draw the front view, sectional top view and true shape of the section.	20	KTU-June 2024
9	A hexagonal pyramid of base 30 mm and axis 60 mm rests on its base on HP with two base edges perpendicular to VP. It is cut by a plane perpendicular to VP and inclined at 30 degree to the HP meeting the axis at 25 mm from the vertex. Draw the elevation, sectional plan and true shape of the section. What is the maximum true length of the side in the section of the pyramid	20	KTU-May 2024
10	Draw the development of the lateral surface of a right regular hexagonal prism of 20 mm base edge and 60 mm height. An ant moves on its surface from a corner on the base to the diametrically opposite corner of the top face by the shortest route. Sketch the path of the ant in the elevation.	20	KTU-May 2024
Qn. No.	Module- 4	Marks	Year
1	A hemisphere of diameter 60 mm is placed centrally over a square slab of side 50mm and height 40 mm, with its flat surface facing upward. Draw the isometric view of the combination.	20	KTU-June 2023
2	A hexagonal pyramid of base edge 25 mm and height 40 mm is surmounted centrally over a cube of 50 mm side. The cube is lying on HP on one of its square face so that one base edge of the cube and one base edge of the pyramid are parallel to VP. Draw the isometric view of the combination.	20	KTU-June 2023

3	A cylindrical slab, 60 mm in diameter and 20 mm thick is surmounted by a cube of 30 mm side. The axes of the solids are in the same vertical line. Draw the isometric projection of the solids	20	KTU-Dec 2023
4	A waste paper basket is in the form of a frustum of hexagonal pyramid with base 100 mm hexagon and top 150 mm hexagon. Draw the isometric view if its height is 40 cm.	20	KTU-Dec 2023
5	A cube of side 52 mm is resting on HP on one of its faces with one of the base edges parallel to VP. A cone with base diameter 46 mm and height 48 mm is resting on the cube on its base with axes of both the solids coinciding each other. Draw the isometric view of the combination of solid.	20	KTU-Jan 2024
6	A square pyramid of base side 40 mm and height 46 mm rests on its base on top of a hexagonal prism of base side 40 mm and height 36 mm with both the axes coinciding each other. One of the base edges of both the solids are parallel to VP. Draw the isometric view of the combination of solid.	20	KTU-Jan 2024
7	A cone of base diameter 40mm and axis length 60 mm is resting centrally over a square slab of edge length 50 mm and thickness 20 mm. Draw the isometric view of the combination of the solids.	20	KTU-June 2024
8	Draw the isometric projection of a pentagonal prism of base edge length 30 mm and axis length 65 mm, which is lying on the ground on one of its rectangular faces. Assume that the axis of the solid is perpendicular to the vertical plane, while it is resting.	20	KTU-June 2024
9	A frustum of a cone of base diameter 50 mm, top diameter 30 mm and height 50 mm resting upon its base on HP. Draw the isometric view of the frustum	20	KTU-May 2024
10	Draw the isometric projection of a sphere of 50 mm diameter resting centrally on a cube of side 30 mm.	20	KTU-May 2024

PCMET 205	MATERIAL SCIENCE AND ENGINEERING	CREDITS	Year of Introduction
		4	2024
MODULE 1			
1	Derive the expression for atomic packing factor for the FCC crystal structure	5	July 2017
2	What is critical shear? Explain.	5	Dec 2020
3	What is the importance of Miller indices? Explain the procedure for determining Miller indices for a plane.	5	Dec 2022
4	Differentiate between slip and twin? Differentiate between their mechanisms	5	Dec 2023
5	What are crystallographic planes?	5	Dec 2022
6	What is plastic deformation?	5	Dec 2020
7	Describe the plastic deformation of metals.	5	Dec 2020
8	Explain Schmid's Law.	5	Dec 2020
9	Explain the terms 'atomic packing factor' and 'co-ordination number'.	5	Dec 2020
10	What are the miller indices? Explain the procedure for obtaining miller indices for any crystallographic plane with a suitable example.	5	Dec 2021
11	Sketch within a cubic unit cell the following planes $(1\ 1\ \bar{1})$, $(\bar{1}\ 0)$, $(0\ 0\ 1)$ and directions $[1\ 1\ 1]$, $[1\ 0\ 1]$	10	Dec 2017
12	What is a slip system? Describe the slip systems in FCC, BCC and HCP metal	10	Dec 2017
13	What is plastic deformation? Describe the slip and twinning modes of deformation with the simple Sketches	10	Dec 2020
14	What is the APF for SC, BCC and FCC crystal structure?	10	Dec 2020
MODULE 2			
1	What is meant by surface defects? List the type of surface defects observed in crystalline materials.	5	Dec 2021
2	Describe the frank read source theory of dislocations.	5	Dec 2020
3	Derive an expression for diffusion coefficient.	5	July 2022
4	What is self-diffusion?	5	Dec 2023
5	Explain the diffusion process briefly.	5	Dec 2020
6	Discuss vacancy diffusion and interstitial diffusion with neat sketches.	7	Dec 2021
7	What is the difference between edge and screw dislocation.	5	Dec 2021
8	Give an account of Fick's laws of diffusion	5	Dec 2021
9	What is a line defect? What are the two types of line defects? Explain.	5	Dec 2023
10	Explain mechanisms of plastic deformation of metals by slip and twinning.	10	July 2017
11	Compare edge dislocation and screw dislocation b. State and explain Fick's second law	10	July 2017
12	Describe the working of SEM with a neat sketch	10	Dec 2017
13	Explain the steps involved in the preparation of specimen for metallographic examination. Mention at least four differences between SEM & TEM	10	Dec 2018
14	Explain different types of point defects/ Explain the following point imperfections	10	Dec 2021

	(a)vacancy (b) interstitial (c) Frenkel defect		
15	Define dislocation? With the help of simple sketches differentiate between edge dislocation and screw dislocation	10	Dec 2020
MODULE 3			
1	What is meant by Maraging steel?	5	July 2017
2	Define creep. Write a short note on creep. Write a note on mechanism of creep.	5	Dec 2022
3	Draw a typical creep curve and mark different zones./ What is a creep curve	7	Dec 2018
4	Explain the fatigue failure of metals. Discuss the factors that affect fatigue	5	Dec 2023
5	Write a note on creep resistant materials.	5	Dec 2022
6	Discuss the mechanism of fatigue	5	Dec 2023
7	Define fatigue. What is endurance limit? Define fatigue limit.	5	Dec 2023
8	Define creep? Sketch a typical creep curve and explain different stages of creep	7	Dec 2018
9	Explain the mechanism of fatigue.	5	July 2017
10	Explain Ductile to Brittle Transition Temperature. List the factors affecting this phenomenon. (b) Define Fracture toughness.	10	July 2017
11	Define ceramics? Enumerate the types of ceramics? Mention any two advantages of ceramics. b) Describe about nuclear materials.	10	Dec 2018
12	List the classification of composites. Explain about any two types of composites.	10	Dec 2018
13	What is the significance of ductile to brittle transition temperature?	5	Dec 2022
MODULE 4			
1	Differentiate between peritectic and peritectoid reactions.	5	Dec 2018
2	State Hume Rothery rules. Explain various Hume Rothery rules for solid solution formation.	5	July 2017
3	Differentiate between eutectic and eutectoid reactions.	5	Dec 2023
4	Discuss significance of Gibb's phase rule. What are its applications?	5	Dec 2018
5	What is Fe ₃ C? How does it affect the properties of steel	5	Dec 2022
6	Explain the lever rule with reference to equilibrium diagrams	5	Dec 2018
7	Explain the features of ferrite, pearlite, austenite, ledeburite, cementite, bainite and martensite	10	July 2017
8	Draw the Iron-Carbon equilibrium diagram and explain the invariant reactions associated with steel.	10	Dec 2018
9	How are solid solutions classified? What are the two types of solid solutions? Give examples. What are the possible kinds of solid solutions?	10	Dec 2022
10	Distinguish between hardening and case hardening.	5	July 2017
11	Explain Jominy end quench test for hardenability with neat diagrams.	6	Nov 2024
12	With the help of an Iron-Carbon phase diagram explain the eutectoid, eutectic and peritectic reaction of iron carbon alloy system.	10	Nov 2024

3	<p>Calculate equivalent resistance across B and A</p> 	8	KTU-DEC 2023
4	<p>a) A resistor of 5Ω is connected in parallel with a resistor of $R_1\Omega$. This combination is connected in series with an unknown resistor of $R_2\Omega$ and the complete circuit is then connected to 50 V dc supply. Calculate the values of R_1 and R_2, if the power dissipated by the unknown resistor R_1 is 150 W with 5 A passing through it.</p>	5	KTU-DE C 2023
	<p>b) By applying Kirchhoff's laws calculate current flowing through the 6Ω resistor in the network shown</p> 	5	KTU-DE C 2022
5	<p>a) State and explain ohms law</p>	4	KTU DEC2022

	<p>b) Find the source current I in the below figure using star-delta transformation.</p>	10	KTU-D EC 2021
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6	<p>a) Define the terms i) mmf ii) magnetic field strength iii) magnetic flux and iv) magnetic flux density State and explain i) Faraday's laws and ii) Lenz's law</p>	4	KTU MAY 2021
	<p>b) alternating current is represented by $i(t) = 14.14 \sin(377t)$. Find (i) rms value (ii) frequency (iii) time period and (iv) instantaneous value of the current at $t = 3\text{ms}$.</p>	4	
	<p>c) An alternating current varying sinusoidally with a frequency of 50Hz has an rms value of 20A. i) Write down the equation for the instantaneous current ii) Find the instantaneous value of current at 0.0025s. iii) Find the instantaneous value of current 0.125s after passing through a positive maximum value iv) At what time, measured from a positive maximum value, will the instantaneous current be 14.14 A?</p>	4	KTU DEC2020
7	<p>a) Two impedances Z_1 and Z_2 when connected separately across a 220V, 50 Hz supply, consume 300W and 150W at a power factor of 0.4 lagging and 0.7 leading respectively. When the two impedances are connected in series across the same supply, find total power consumed and overall power factor.</p>	10	KTU DEC- 2020

	<p>b)A balanced three phase load has per phase impedance of $(30+j50) \Omega$. If the load is connected across 400V, 3 phase supply, find</p> <p>(i) phase current (ii) line current and (iii) power supplied to load when it is connected in (a) star (b) delta</p>	8	KTU DEC- 2019
8	<p>a)In a single phase ac circuit consisting of an impedance of 10Ω, the RMS value of applied voltage is 230V.</p> <p>i. Write down the expression for instantaneous voltage ii. If the current lags the applied voltage by 30° write down the expression for instantaneous current Calculate the power consumed in the circuit</p>	10	KTU DEC- 2019
	<p>b)A coil of resistance 10Ω and inductance 0.1 H is connected in series with a $150 \mu\text{F}$ capacitor across 200V, 50 Hz supply. Calculate (i) Inductive reactance, Capacitance reactance, impedance, current and power factor. (ii) The voltage across the coil and capacitor respectively.</p>	9	KTU DEC- 2019
9	<p>An alternating voltage is defined as $v=100 \sin \alpha$ $0<\alpha<\pi$ $v=0V$ $\pi<\alpha<2\pi$ What is the RMS value of this voltage</p>	7	KTU DEC- 2018
10	<p>A balanced 3 phase load consists of 3 coils each of resistance 6Ω and inductive reactance of 8Ω. Determine the line current and power absorbed when the coils are (i) star connected (ii) delta connected across 400V, 3 phase supply.</p>	9	KTU DEC- 2018

MODULE 2

SI No		Marks	KTU, Year
1	a)Explain the advantages of three-phase systems over single-phase systems in power generation and transmission	4	KTU DEC2024
	b)Explain the need for high-voltage transmission in power distribution.	5	KTU DEC2024

2	a) Explain primary and secondary transmission and distribution systems	5	KTU DEC2023
	b) What are the different types of DC generators?	5	KTU DEC2023
3	a) Derive the EMF equation for a single-phase transformer.	5	KTU DEC2023
	b) Explain why a single-phase induction motor is not self-starting.	7	KTU DEC2022
4	a) Describe two starting methods for a single-phase induction motor.	7	KTU DEC2022
	b) An alternating voltage $v = 200 \sin 314t$ is applied to a device that offers an ohmic resistance of 20Ω to the flow of current in one direction while entirely preventing the flow of current in the opposite direction. Calculate the r.m.s. value, average value and form factor	7	KTU DEC2022
5	a) Describe the concepts of active power, reactive power, and apparent power in AC circuits, and represent their relationship using a power triangle.	10	KTU DEC2021
	b) Draw the schematic of a hydroelectric power plant and explain the working.	10	KTU DEC2021
6	Draw the schematic of a thermal power plant and explain the working.	10	KTU DEC2021
7	Explain the construction and working principle of a single-phase transformer.	9	KTU DEC2020
8	Explain the constructional features of squirrel cage and slip ring induction motors and highlight the differences between them.	9	KTU DEC2020
9	a) Define synchronous speed and slip of a three-phase induction motor.	4	KTU DEC2019
	b) A 3-phase induction motor is wound for 8 poles and is supplied from a 50 Hz source. Calculate (1) synchronous speed (2) slip of the motor when the speed is 720rpm	7	KTU DEC2019

10	Define R.M.S value and Average value of an alternating current.	7	KTU DEC2018
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**GZEST204 INTRODUCTION TO ELECTRICAL AND ELECTRONICS ENGINEERING
(PART-2)QUESTION BANK**

Qn.No	MODULE-3	Marks	Year
1	Distinguish between active and passive electronic components With examples for each	4	KTUDEC2020
2	a. Draw the symbol of the resistor and explain any four specifications. b. Explain the colour coding of the resistor. Illustrate with examples. What are the merits and demerits of resistor colour coding schemes? c. In a 4-band resistor the last colour in the colour band is gold. If the upper range of resistance is 3.465Ω find its colour code. Write down the colour code for a given resistor Of 47kilo-ohms with a tolerance of 10%.	4 6 4	KTUDEC2022& JAN2024 KTUJUN2023 & JAN2024 KTUJUL2021
3	a. What is an inductor? How does an inductor work What are the different types of inductors? Give two typical applications of inductors. b. What do you mean by permeability tuning? Identify and sketch any one electronic component that employs permeability tuning and explain the tuning mechanism.	5 4	KTUDEC2022 KTUJUN2023
4	a. What is a variable capacitor? List any two applications of variable capacitors. b. Write the significance of specifying the tolerance value of a component. Find the capacitance values for the following Codes (i)2n2(ii)104K(iii)103J	4 4	KTUJAN2024 KTUDEC2021
5	a. What is the depletion region of a diode? How is it formed? b. Draw and explain the VI characteristics of a PN junction diode under forward and reverse bias	4 4	KTUJAN2024 KTUJUN2023
6	a. Compare the three transistor configurations. b. Discuss the parameters 'alpha' and 'beta' of a transistor and	4	KTUDEC2022

	quote the relationship between them. (OR) Derive the relation between common base current gain and common emitter current gain.	6	KTUDEC2022& JAN 2024
	c. The collector current of a transistor varies by 1.987 mA when its emitter current is varied by 2 mA. Compute the alpha and beta of the transistor.	4	KTUDEC2022
	d. For an NPN transistor, $\alpha=0.95$ and $I_E=10\text{mA}$. Find I_B and I_C .	4	KTUJUN2022
7	Draw and explain the circuit diagram, and input and output characteristics of a transistor in common emitter configuration. With a neat diagram, mention any one application of the Transistor in common emitter configuration.	10	KTUJUN2023& JAN 2024
8	a. Draw the block diagram of the DC power supply and explain the function of each block	10	KTUJUN2022
	b. Sketch and explain the working of a full wave bridge rectifier with a capacitor filter. Draw its input and output waveforms. Suggest methods to reduce the ripple content of the output.	10	KTUJUN2023& JAN 2024
	c. Draw the circuit diagram of a simple zener voltage regulator and explain its working. Define the terms line regulation and load regulation.	6	KTUJUN2023
9	a. Draw the circuit diagram of a CE amplifier (RC-coupled) and discuss the role of each component used in it. Draw its frequency response and mark the 3dB bandwidth. Give reasons for the decrease in transistor amplifier voltage gain at low frequencies and high frequencies	10	KTU JUN 2022, JUN2023&JAN 2024
	b. Draw the circuit of voltage divider biasing arrangement and mention the functions of various components used in the circuit.	6	KTUDEC2022
10	a. Explain the basic structure of a Field Effect Transistor (FET).	4	Model Questions
	b. What are the differences between N-channel and P-channel MOSFETs?	4	
	c. Describe the pinch-off condition in a MOSFET.	4	
	d. State the advantages of MOSFETs over BJTs (Bipolar	4	

	Junction Transistors).		
	a. With the help of diagrams, explain the construction and working of an N-channel MOSFET.	8	Model Questions
	b. Discuss the construction, operation, and characteristics of a P-channel MOSFET.	8	
	c. Explain the role of gate voltage in controlling the conductivity of an N-channel MOSFET and compare it with a P-channel MOSFET.	8	
	d. Compare and contrast the operation of depletion-mode and enhancement-mode MOSFETs with respect to N-Channel and P-channel devices.	8	

Qn. No	MODULE-4	Marks	Year
1	a. What is modulation? Compare AM and FM.	4	KTUJUN2023 & JAN 2024 KTUJUN2023
	b. Explain the term 'modulation index' in a radio communication system. An AM-modulated carrier wave has maximum and minimum amplitudes of 600mV and 450mV respectively. Find the modulation index.	6	
	c. Write the expression for an AM wave and comment on the bandwidth requirement and modulation index.	5	KTUDEC2020
	d. Draw the frequency spectrum of an amplitude-modulated (AM) wave. Given that the modulating signal is of frequency f_m and amplitude V_m and the carrier is of frequency f_c and amplitude V_c . Take the modulation index as m . What is the bandwidth requirement of this AM wave?	5	KTUJUL 2021
	e. State the merits and demerits of Amplitude Modulation.		
	f. Write the frequency range and typical applications of VHF and UHF frequency bands	4 4	KTUJUN2022 KTUJUN2022
2	With the necessary block diagram explain the principle of a superheterodyne receiver or AM Superheterodyne receiver. Explain the relevance of intermediate frequency in a Superheterodyne receiver	6	KTUDEC2022

3	Describe the principle and working of an antenna	6	KTUJUN2022 KTUJAN2024
4	a. What is the basic principle of cellular communication? b. Draw the block diagram of a GSM system and explain its working principle. c. Discuss the concepts of cellsplitting and frequency reuse in A cellular communication system.	4 10 6	KTU DEC 2022 KTUJUN2023& JAN 2024 KTUJAN2024
5	Explain the block diagram of an instrumentation system.	6	KTUJUN2023
6	Compare the evolution of 3G,4G,and5G communication Technologies in terms of speed, latency, and applications.	8	ModelQuestion
7	a. With a neat block diagram, explain the working of a Function Generator and its applications. b. Draw and explain the block diagram of a Digital Multimeter and its various measurement modes. c. Compare the functionalities of a Digital Multimeter and Function Generator in testing electronic circuits.	8 8 8	ModelQuestions
8	a. Describe the working of a Cathode Ray Oscilloscope (CRO) with a block diagram. b. Explain how Lissajous patterns can be used to measure Frequency and phase differences between two signals. Provide suitable examples.	8 6	ModelQuestions
9	Discuss how IoT-based solutions are transforming health care, Providing a specific case study to highlight its impact.	8	ModelQuestion

QUESTION BANK
ENGINEERING CHEMISTRY (GCCYT 122)

Updated on 13/01/2024

Ms. Anchu E S

AP in Chemistry

Dept. Of Applied Science

COMPILED BY
DEPARTMENT OF APPLIED SCIENCE
VIDYA ACADEMY OF SCIENCE AND TECHNOLOGY TECHNICAL
CAMPUS, KILIMANOOR

MODULE I
Engineering Materials

Sl. No:	Questions	Marks	KTU Year
1	What is Gypsum, and what role does it play in the production of cement ?	(3)	Dec 2024
2	Write an overview of Green Hydrogen	(3)	Dec 2024
3	What instrumental method covered in this course would you recommend for measuring the calorific value of solid fuels? Please give an overview of the instrumentation, its operational principle, and the calculations used to determine the Higher Calorific Value (HCV) and Lower Calorific Value(LCV)	(6)	Dec 2024
4	Explain how the aniline point of a lubricant is measured and discuss its significance in the context of lubricant performance.	(3)	Dec 2024
5	Write a brief note on the following: (a) Cetane Number(b)Aniline Point(c) Sol-Gel method	(6)	
6	Calculate the higher and lower calorific values(in kcal/kg) of a fuel sample containing 84% carbon, 1.5% sulphur, 1.4% Nitrogen , 8%Hydrogen and 4% Oxygen.	(3)	
7	Discuss the steps involved in the manufacture of Portland cement	(6)	
8	Discuss any one method for the synthesis of polypyrrole and give two applications of it.		

MODULE II
Electrochemistry and Corrosion Science

Sl. No:	Questions	Marks	KTU Year
1.	Write any three difference between Electrochemical series and Galvanic Series.	(3)	2024 Dec
2.	What is Fuel Cell? Write the chemical reactions happening at the anode and cathode	(3)	2024 Dec
3.	Discuss the design of a Glass electrode and explain how a glass electrode can be employed in the measurement of PH of a solution	(6)	2024 Dec
4.	Describe the construction and Working of Lithium -ion cell	(6)	2024 Dec
5.	Write any three applications of Electrochemical series	(3)	2024 Dec
6.	How Sacrificial anode protection can be used for the prevention of corrosion	(3)	2024 Dec
7.	Discuss any three applications of Nernst Equation	(3)	
8.	Discuss the mechanism of Electrochemical Corrosion	(6)	

MODULE III

Molecular spectroscopy and Analytical techniques

Sl. No:	Questions	Marks	KTU Year
1.	How is Polyaniline synthesized?	(3)	2024 Dec
2.	Write any three applications of Carbon Nanotubes	(3)	2024 Dec
3.	Explain the various electronic transitions in electronic spectroscopy	(6)	2024 Dec
4.	Discuss the IR activity of various vibrational modes of CO ₂ molecule	(3)	2024 Dec
5.	State Beer-Lambert's Law. Write the mathematical expression	(3)	2024 Dec
6.	Briefly discuss the principle, working and any two applications of SEM	(6)	2024 Dec
7.	Brief out the instrumentation and working of dielectric thermal analysis technique (DETA)	(6)	
8	With the help of a block diagram. Explain the instrumentation of UV -visible spectroscopy	(6)	

MODULE IV
Environmental Chemistry

Sl. No:	Questions	Marks	KTU Year
1.	What is cod? Give its significance.	(3)	Dec 2024
2.	Calculate the temporary, permanent and total hardness of water with the following salts: Ca (HCO ₃) ₂ = 6ppm, Mg(HCO ₃) ₂ =8ppm, CaSO ₄ =10ppm, MgSO ₄ = 15ppm	(3)	Dec 2024
3.	Describe Trickling filter method in the sewage water treatment	(3)	Dec 2024
4.	Discuss any three sustainable development goals	(3)	Dec 2024
5	Write the principle and any two advantages of Reverse Osmosis	(3)	Dec 2024
6	What are iron exchange resins? Explain iron exchange process used for demineralization of water. How exhausted resins are regenerated.	(6)	Dec 2024
7	Discuss the chemistry behind ozone depletion	(3)	Dec 2024
8	Explain the three major aspects of sustainable development. List any three SDGs where Chemistry plays a crucial role.	(6)	

MODULE V

1	Describe EDTA method for the estimation of hardness?	(4)	2022
2	Distinguish between aerobic and anaerobic oxidation	(6)	2019 2024
3	Explain reverse osmosis process?	(3)	2023,2018
4	Explain with flow chart, how water is purified for drinking purposes?	(10)	2021
5	Explain the process chlorination and break point of chlorination	(3)	2017
6	Explain BOD & COD?	(4)	2017,2021, 2024
7	Write a note on aerobic & anaerobic waste water treatment	(10)	2020
8	Discuss the procedure for the determination of DO in water.	(6)	2020, 2024
9	Explain the ion exchange process in water treatment. How is the exhausted resin regenerated?	(6)	2023, 2024
10	Explain primary, secondary and tertiary process involved in sewage water treatment with the help of flow diagram	(8)	2021