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CODE: 18BST103

SET-2

**ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI
(AUTONOMOUS)**

I B.Tech II Semester Supplementary Examinations, August, 2025

**Differential Equations
(Common to CE, ME, CSE, IT Branches)**

Time: 3 Hours

Max Marks: 60

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

UNIT-I

1. a) Solve $\cos^2 x \frac{dy}{dx} + y = \tan x$ 6M
 - b) Solve $(x^4 e^x - 2mxy^2)dx + 2mx^2 y dy = 0$ 6M
- (OR)**
2. a) Find orthogonal trajectories of the family of curves $r^2 = a^2 \cos 2\theta$ 6M
 - b) The magnitude for natural substance increases from 70 to 150 units in 15 minutes. Find the time required for the magnitude to be 225 units. Also find the magnitude of the substance after 10 minutes. 6M

UNIT-II

3. a) If $\frac{d^4 x}{dt^4} = m^4 x$, Show that $x = C_1 \cos mt + C_2 \sin mt + C_3 \cosh mt + C_4 \sinh mt$. 6M
 - b) Solve $\frac{d^2 y}{dx^2} + 9y = \cos 2x$, if $y(0) = 1$, $y\left(\frac{\pi}{2}\right) = -1$ 6M
- (OR)**
4. a) Solve the differential equation $\frac{d^2 y}{dx^2} + y = 2 \sin x$ 6M
 - b) Solve by the method of variation of parameters $\frac{d^2 y}{dx^2} + y = \operatorname{Cosec} x$ 6M

UNIT-III

5. a) Prove that $J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}} \sin x$ 6M
 - b) Express $J_5(x)$ in terms of $J_0(x)$ and $J_1(x)$ 6M
- (OR)**
6. a) Prove the recurrence relation $(n+1)P_{n+1}(x) = (2n+1)xP_n(x) - nP_{n-1}(x)$ 6M
 - b) Demonstrate $f(x) = x^4 + 3x^3 - x^2 + 5x - 2$ in terms of Legendre polynomials. 6M

UNIT-IV

7. a) Form the partial differential equation by eliminating arbitrary functions from $z = f(x + at) + g(x - at)$. 6M
b) Solve $p \tan x + q \tan y = \tan z$ 6M
- (OR)**
8. a) Solve $(mz - ny) \frac{\partial z}{\partial x} + (nx - lz) \frac{\partial z}{\partial y} = ly - mx$. 6M
b) Solve $(p^2 + q^2)y = qz$ 6M

UNIT-V

9. a) Solve $(D^2 + DD' - 6D'^2)z = \cos(2x + 3y)$ 6M
b) Solve $\frac{\partial^3 z}{\partial x^3} - 2 \frac{\partial^3 z}{\partial x^2 \partial y} = 3x^2 y$ 6M
- (OR)**
10. a) Solve $(D - D' - 1)(D - D' - 2)z = e^{2x-y}$ 6M
b) Solve $(D^2 + 2DD' + D'^2 - 2D - 2D')z = \sin(x + 2y)$ 6M

**ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI
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I B. Tech II Semester Supplementary Examinations, August, 2025

APPLIED PHYSICS

(Common to CSE, CSE(AIML), CSE(DS) & IT Branches)

Time: 3 Hours

Max Marks: 60

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

UNIT-I

1. a) With ray diagram discuss the theory of thin films and derive the condition for constructive and destructive interference in the case of reflected system. 7
- b) What is the thickness of the thinnest film of refractive index 1.33 in which the destructive interference of the yellow light (6000 \AA) of a normally incident beam can take place by reflection? 3

(OR)

2. a) Give the theory of Fraunhofer diffraction due to a single slit and hence obtain the condition for primary and secondary maxima. Using this obtain intensity distribution curve. 10

UNIT-II

3. a) What is meant by a laser? Explain the characteristics of lasers. 5
- b) What are the applications of Lasers in Industry, Science and Medical Fields. 5

(OR)

4. With the help of suitable diagrams explain the principle, construction and working of He-Ne gas laser. 10

UNIT-III

5. a) What are the various applications of optical fibers? 6
- b) Describe the construction of an optical fiber and give typical dimensions of various parts. 4

(OR)

6. Draw the block diagram of fiber optic communication system and explain the function each. 10

UNIT-IV

7. a) Explain the physical significance of wave function 3
- b) Derive the time independent Schrodinger wave equation. 7

(OR)

8. a) Discuss the de-Broglie's hypothesis of duality of material particles. 6
- b) Calculate the de-Broglie wavelength associated with a neutron moving with a velocity of 2000 m/s . (mass of neutron, $m = 1.67 \times 10^{-27} \text{ kg}$, Planck's constant, $h = 6.626 \times 10^{-34} \text{ J-s}$) 4

UNIT-V

9. a) What is Lenz's law of electromagnetic induction? Write Maxwell's equations in differential form. 6
- b) State and explain Gauss Law in electrostatics. 4

(OR)

10. a) Define Gradient, divergence and curl of a vector. Explain their physical significance 5
- b) Derive the differential form of Gauss Law 5

UNIT-VI

11. Show that the Fermi level is at the middle of the conduction band and valence band. 10

(OR)

12. Define the drift and diffusion currents in semiconductor. State and explain Hall effect. 10

**ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI
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I B. Tech II Semester Supplementary Examinations, August, 2025

**ENGINEERING PHYSICS
(Mechanical Engineering)**

Time: 3 Hours

Max Marks: 60

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

UNIT-I

1. a) Define the forced oscillations. Explain, how to solve the differential equation of a forced harmonic oscillator. 7
- b) The Q-factor of an oscillator is 500. Find the initial energy if its amplitude is 0.01 m. Also, calculate the energy lost in the first cycle. 3

(OR)

2. a) Explain the Q factor in mechanical. 2
- b) Find the solution for the differential equation of a **damped** harmonic oscillator and explain underdamped and overdamped conditions. 8

UNIT-II

3. a) What are the conditions for light interference? 2
- b) Explain the formation of interference in thin films by reflected light and derive the cosine law. 8

(OR)

4. a) What is the diffraction of light? Discuss the phenomena of Fraunhofer diffraction at a single slit for intensity distribution. 8
- b) Newton's rings are observed with a plano-convex lens in contact with a glass plate. The radius of the first bright ring is 0.1 cm. If the radius of the convex surface is 400 cm, what wavelength is used? 2

UNIT-III

5. a) Discuss the Einstein's coefficients in laser. 3
- b) Describe the construction and working of He – Ne gas laser with a neat sketch energy level diagram 7

(OR)

6. a) Calculate the energy and momentum of a photon of a laser beam of Wavelength 6943 Å. 4
- b) Explain the applications of laser in industry and medical field. 6

UNIT-IV

7. a) Explain the structure of the optical fiber. 4
- b) Discuss the optical fibers in the communication system with a neat diagram. 6

(OR)

8. a) Calculate the refractive indices of the core material of an optical fiber whose numerical aperture is 0.32 and cladding refractive index is 1.54 2
- b) What is the acceptance angle? Derive an expression for the acceptance angle and acceptance cone of a step-index optical fiber. 8

UNIT-V

9. a) What are the coordination number and Miller indices? Discuss the significance of Miller indices 4
- b) Describe the structure of SC and FCC crystal structures. 6

(OR)

10. a) Calculate the packing factor for chromium metal having BCC structure if its density is 5.96 gm/cc and atomic weight is 50. 2
- b) Explain the seven crystal systems and Bravais lattices in the crystal structure. 8

UNIT-VI

11. a) What do you mean by critical temperature? Explain in contrast to type-I and type-II superconductors. 7
- b) Write some important applications of superconductors. 3

(OR)

12. a) Classify the materials based on their behavior in magnetic fields and compare their properties with suitable examples. 8
- b) Find the relative permeability of ferromagnetic material of a field strength of 220 amp/meter produces a magnetization of 3300 amp/meter in it. 2

**ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI
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I B. Tech II Semester Supplementary Examinations, August - 2025

CHEMISTRY

(Common to Civil, EEE & ECE Branches)

Time: 3 Hours

Max Marks: 60

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

UNIT-I

1. a) Explain the Zeolite process for water softening with a neat diagram. 5M
- b) Define and differentiate between Temporary and Permanent Hardness of water. 5M

(OR)

2. a) Describe the Ion Exchange Process for water softening. 5M
- b) Write a short note on Disinfection and Sterilization. 5M

UNIT-II

3. a) Discuss the Principle of NMR Spectroscopy. 5M
- b) Explain the following terms: 5M
 - i) Hypsochromic shift
 - ii) Hyperchromic shift

(OR)

4. a) Describe the different types of electronic transitions in the UV-visible region. 5M
- b) Define Spectroscopy and explain the applications of IR Spectroscopy 5M

UNIT-III

5. a) Explain the preparation, properties, and applications of Bakelite polymer. 5M
- b) Write a short note on Functionality and Degree of Polymerization. 5M

(OR)

6. a) Differentiate between Thermoplastic and Thermosetting Polymers. 5M
- b) Explain any one moulding technique for thermoplastics with a neat diagram 5M

UNIT-IV

7. a) Write a note on the Claisen Reaction. 5M
- b) Explain the reaction and mechanism of Electrophilic Addition Reactions with an appropriate example. 5M

(OR)

8. a) Describe the reaction and mechanism of the Pinacol-Pinacolone Rearrangement. 5M
- b) Explain SN1 and SN2 mechanisms with suitable examples. 5M

UNIT-V

9. a) Describe the mechanism of rusting of iron in an acidic environment with relevant chemical equations. 5M
- b) Explain the principle and process of Galvanization with a neat diagram. 5M

(OR)

10. a) Discuss the factors influencing the rate of corrosion. 5M
- b) Explain the principle and process of Tinning with a neat diagram. 5M

UNIT-VI

11. a) Differentiate between Batteries and Supercapacitors. 5M
- b) Explain any five principles of Green Chemistry. 5M

(OR)

12. a) Describe the conversion of solar energy into electricity using a photovoltaic cell, with a neat diagram. 5M
- b) Write a note on Renewable and Non-Renewable Energy Sources. 5M

Time: 3 Hours

Max Marks: 70

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

<u>UNIT-I</u>		Marks	CO	Blooms Level
1. a)	Solve $xy' + 2y - x \sin x = 0$.	7M	CO1	K3
b)	A bacterial population B is known to have a rate of growth \propto to B itself. If between <i>noon</i> and <i>2PM</i> the population triples, at what time, no controls being exerted, should B become 100 times what it was at <i>noon</i> .	7M	CO1	K3
(OR)				
2. a)	Solve $\frac{dy}{dx} + \frac{y}{x} = x^2 y^6$.	7M	CO1	K3
b)	Water at temperature 100°C cools in 10min to 80°C in a room of temperature 25°C . (i) Find the temperature of water after 20min . when is the temperature (ii) 40°C ?	7M	CO1	K3
<u>UNIT-II</u>				
3. a)	Solve $y'' + 6y' + 13y = 0, y(0) = 3, y'(0) = -1$.	7M	CO2	K3
b)	Solve $(D^2 - 4D - 5)y = e^{2x} + 3 \cos(4x + 3)$.	7M	CO2	K3
(OR)				
4.	Solve $(D^2 + 4)y = \sec(2x)$ by the method of variation of parameters.	14M	CO2	K3
<u>UNIT-III</u>				
5. a)	Describe (obtain) partial differential equation by eliminating the arbitrary constants from $z = ax + by + a^2 + b^2$.	7M	CO3	K1
b)	Find the solution of $yzp - xzq = xy$.	7M	CO3	K1
(OR)				
6. a)	Find the solution of $q^2 = z^2 p^2 (1 - p^2)$.	7M	CO3	K1
b)	Find the solution of $(2D_x^2 + 5D_x D_y + 2D_y^2) = 0$.	7M	CO3	K1
<u>UNIT-IV</u>				
7. a)	A particle moves along the curve $x = 2t^2, y = t^2 - 4t, z = 3t - 5$ where t is the time. Compute the components of its velocity and acceleration at time $t = 1$ in the direction $i - 3j + 2k$.	7M	CO4	K2
b)	Compute the curl of $yzi + 3zxj + zk$ at $(2, 3, 4)$.	7M	CO4	K2
(OR)				
8. a)	If $f(x, y, z) = 3x^2y - y^3z^2$, then Compute ∇f and $ \nabla f $ at $(1, -2, -1)$.	7M	CO4	K2
b)	Show that $\nabla^2 r^n = n(n+1)r^{n-2}$ where n is a constant.	7M	CO4	K2
<u>UNIT-V</u>				
9.	Verify Green's theorem for $\int_C (xy + y^2)dx + x^2 dy$ where C is the curve bounded by $y = x^2$ and $y = x$	14M	CO5	K5
(OR)				
10.	Verify Gauss divergence theorem for $\vec{A} = (x^3 - yz)i - 2x^2 yj + zk$ taken over the entire surface of the cube $0 \leq x \leq a, 0 \leq y \leq a$ and $0 \leq z \leq a$.	14M	CO5	K5