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**B.Tech (Bio-Tech) 3rd Semester G-Scheme
Examination, December-2025**

BIOLOGY

Paper-BSC-BIO-201-G

Time allowed : 3 hours]

[Maximum marks : 75

Note : Attempt any five questions, selecting one question from each unit. All questions carry equal marks.

1. Write short note on the following : $6 \times 2.5 = 15$
- (a) Mendel's Second law of inheritance
 - (b) Watson and Crick model of DNA
 - (c) Plasmid Vectors
 - (d) Sewage treatment
 - (e) Differentiate between glucose and cellulose.
 - (f) Genetically modified crops

Unit-I

2. Distinguish between Prokaryotic and Eukaryotic cells. Explain the key differences in their structure and function. 15

3018-P-3-Q-9 (25)

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3. Describe the central dogma of molecular biology and explain the concept of genetic code. How does it relate to the synthesis of proteins? 15

Unit-II

4. Explain the structure and functions of proteins, including the primary, secondary, tertiary and quaternary levels of organization. Provide examples of proteins with different functions. 15
5. Discuss the structure and functions of lipids, specifically phospholipids and cholesterol. How do they contribute to the structure and function of cell membranes? 15

Unit-III

6. Describe the role of restriction enzymes and DNA modifying enzymes in recombinant DNA technology. How do they facilitate gene cloning? 15
7. What are transgenic plants and animals? Discuss their applications and potential benefits and medicine. 15

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Unit-IV

8. Explain the role of biotechnology in medicine, including the production of therapeutic proteins and vaccines. Provide examples of biotechnological products used in medicine. 15
9. What is enzyme technology? Discuss the applications of enzymes in various industries, such as food, detergent and pharmaceutical industries. 15

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B. Tech 3rd Semester (ME) G-Scheme

Examination, December-2025

PHYSICS-II (OPTICS AND WAVES)

Paper-BSC-ME-201-G

Time allowed : 3 hours]

[Maximum marks : 75

Note : Attempt five questions in all, selecting at least one question from each section. Question No. 1 is compulsory. All questions carry equal marks.

1. (a) An SHM is given by

$$y = 7 \left(\frac{\sqrt{3}}{2} \sin 2\pi t + \frac{1}{2} \cos 2\pi t \right) \text{m. Determine}$$

amplitude (in m) and initial phase of simple harmonic motion. 2.5×6=15

- (b) State Fermat's principle and derive laws of reflection using this principle.
- (c) What is the dispersive power of the grating ? Derive an expression for it.
- (d) Define the following terms : population inversion, metastable state, pumping in lasers.

3056-P-4-Q-9 (25)

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- (e) What are the main components of a laser? Explain in detail.
- (f) Distinguish between interference by division of wavefront and division of amplitude. Give at least two differences.

Section-I

2. Define damped harmonic oscillator. Write the differential equation for this oscillator and find its solution. Discuss damped, over damped and critically damped oscillations. Also derive the expression for average total energy and average power dissipated. 15
3. What is driven harmonic oscillator? Derive differential equation for this oscillator and discuss the condition of resonant amplitude. Show the dependence of the amplitude as a function of driving frequency. 15

Section-II

4. (a) Derive the expression for the velocity of transverse waves in a stretched string. 7
- (b) Find the system matrix for a thick lens and derive the lens formula. 8

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5. Write Fresnel's equation in nonconducting isotropic media when electric field vector E is perpendicular to the plane of incidence (TE mode) and hence derive the relation for transmission and reflection coefficient. 15

Section-III

6. (a) Give construction, theory, working and formation of fringes in Michelson's interferometer. 12
- (b) A shift of 100 circular fringes is observed when the movable mirror of the Michelson interferometer is shifted by 0.295 mm. Calculate the wavelength of light. 3
7. Give the construction and theory of plane transmission grating and explain the formation of spectra by it. 15

Section-IV

8. Explain the phenomenon of absorption, spontaneous emission and stimulated emission. Deduce the relationship between different Einstein's coefficients and explain why high-frequency lasers are not practically possible. 15

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9. (a) What are three and four level lasers ? Discuss with suitable diagram principle, construction and working of He-Ne Laser. 12
- (b) Why two-level lasers are not practically possible ? 3

B.Tech. (ME) 3rd Semester (G-Scheme)
Examination, December-2025
MATHEMATICS-III (PDE, PROBABILITY &
STATISTICS)
Paper- BSC-ME-203-G

Time allowed : 3 hours]

[Maximum marks : 75

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note: *Attempt five questions in all, selecting one question from each Unit. Q. No. 1 is compulsory*

1. (a) solve $\frac{\partial^2 z}{\partial x \partial y} = \sin x \sin y$, given that $\frac{\partial z}{\partial y} = -2 \sin y$, when $x = 0$ and $z = 0$ when y is an odd multiple of $\frac{\pi}{2}$.

(b) Classify the following equations

$$y^2 \frac{\partial^2 u}{\partial x^2} + 2y \frac{\partial^2 u}{\partial x \partial y} + \frac{\partial^2 u}{\partial y^2} - \frac{\partial u}{\partial y} = 8y.$$

(c) Prove that $\frac{d}{dx}[xJ_1(x)] = xJ_0(x)$.

(d) Prove that $P_n(-x) = (-1)^n p_n(x)$.

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- (e) Four cards are drawn from a pack of 52 cards. Find the probability that one card is of each suit.
- (f) The population of a country was 300 million in 1971. It becomes 520 million in 1989. Calculate the percentage compound rate of growth per annum.
- $6 \times 2.5 = 15$

Unit-I

2. (a) Solve the differential equation $(x^2 - yz)p + (y^2 - zx)q = z^2 - xy$. 8
- (b) Solve $\frac{\partial^3 z}{\partial x^3} - 7 \frac{\partial z \partial^2 z}{\partial y \partial y^2} - 6 \frac{\partial^2 z}{\partial y^2} = \sin(x + 2y) + e^{2xy}$. 7
3. (a) Solve $(D^2 - DD' + D' - 1)z = \cos(x + 2y)$. 8
- (b) Solve the wave equation $\frac{\partial^2 y}{\partial t^2} = c^2 \frac{\partial^2 y}{\partial x^2}$ representing the vibrations of a string of length ℓ fixed at both ends, given that $y(0, t) = y(\ell, t) = 0$; $y(x, 0) = f(x)$ and $\frac{\partial y}{\partial t}(x, 0) = 0, 0 < x < \ell$. 7

Unit-II

4. (a) Solve by the method of separation of variables: $\frac{\partial^2 z}{\partial x^2} - 2 \frac{\partial z}{\partial x} + \frac{\partial z}{\partial x} = 0$. 8
- (b) Show that $\int_0^x x^3 J_0(x) dx = x^3 J_1(x) - 2x^2 J_2(x)$. 7

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5. (a) Prove that $nP_n(x) = xP'_n(x) - P'_{n-1}(x)$. 8
- (b) Prove that $P'_n(1) = \frac{n(n+1)}{2}$. 7

Unit-III

6. (a) An urn contains 10 white and 3 black balls, while another urn contains 3 white and 5 black balls. Two balls are drawn from the first urn and put into the second urn and then a ball is drawn from the latter. What is the probability that it is a white ball? 7
- (b) Two bad eggs are mixed accidentally with 10 good ones. Find the probability distribution of the number of bad eggs in 3, drawn at random without replacement, from this lot. 8
7. (a) The probability that a pen manufactured by a company will be defective is $\frac{1}{10}$.
If 12 such pens are manufactured, find the probability that (i) exactly two will be defective (ii) at least two will be defective (iii) none will be defective. 7
- (b) Six coins are tossed 6400 times. Using the Poisson distribution, determine the approximate probability of getting six heads x times. 8

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[P.T.O.]

Unit-IV

8. (a) Calculate mean, median and mode of the following data relating to weight of 120 articles: 7

Weight(in gm):	0-10	10-20	20-30	30-40	40-50	50-60
No. of articles:	14	17	22	26	23	18

- (b) Compute skewness and kurtosis if the first four moments of a frequency distribution $f(x)$ about the value $x = 4$ are respectively 1,4,10 and 45. 8
9. (a) Find the rank correlation coefficient from the following data showing ranks of 10 students in two subjects: 7

Maths:	3	8	9	2	7	10	4	6	1	5
Physics:	5	9	10	1	8	7	3	4	2	6

- (b) The height of 6 randomly chosen sailors in inches are 63, 65, 68, 69, 71 and 72. Those of 9 randomly chosen soldiers are 61, 62, 65, 66, 69, 70, 71, 72 and 73. Test whether the sailors are on the average taller than soldiers. 8

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B.Tech. (ME) 3rd Semester (G-Scheme)

Examination, December-2025

BASICS OF ELECTRONICS ENGINEERING

Paper--ESC-ECE-207-G

Time allowed : 3 hours]

[Maximum marks : 75

Note: Attempt five questions in all. Question No.1 is compulsory. Attempt four more questions selecting exactly one question from each unit. All question carry equal marks.

1. (a) What do you mean by insulators?
- (b) What do you mean by Voltage regulation?
- (c) Draw the block diagram of 16:1 multiplexer.
- (d) What is the need of feedback in amplifier?
- (e) What is Barkhausen's criteria for oscillations?
- (f) Define digital signal. 2.5 × 6 =15

Unit-I

2. (a) What is a PN Junction? Draw its V-I characteristics in different bias Configuration. 10
- (b) Find out the rectification efficiency in half wave rectifier. 5
3. (a) Draw the circuit diagram of a CE amplifier and explain its input output characteristics. 10
- (b) What are the various applications of Zener diode? 5

3058-P-2-Q-9 (25)

[P. T. O.]

Unit-II

4. Write short note on: 15
(a) Op-amp as Integrator
(b) Op-amp as Differentiator
5. Write short note on: 15
(a) Op-amp as summing amplifier
(b) Op-amp as difference amplifier

Unit-III

6. What is Barkhausen's criteria for oscillations? Explain RC phase shift oscillator using NPN transistor. 15
7. (a) Draw and explain the working of a Wien bridge oscillator. 10
(b) Explain an astable multivibrator in detail. 5

Unit-IV

8. Explain the working of J-K flip flop with truth table. 15
9. Explain the following: 15
(a) Full adder
(b) AM and FM modulation

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B.Tech. (Mechanical Engg.) 3rd Semester (G-Scheme)
Examination, December-2025

BASICS OF MECHANICAL ENGINEERING

Paper-- -ESC-ME-211-G

Time allowed : 3 hours]

[Maximum marks : 75

Note: Attempt any five questions in all, selecting one question from each Unit. Question No.1 is compulsory. All questions carry equal marks.

1. Explain the following 2.5 × 6=15
- (a) Stress and types of stress
 - (b) Poisson's Ratio
 - (c) CNC Machines
 - (d) Third law of thermodynamics
 - (e) Working of Francis turbine
 - (f) Selection of turbines.

Unit-I

2. Explain the working of shaper machine. Also explain the different machining operations that can be performed on a shaper machine. 15
3. What do mean by enthalpy and entropy. Discuss in details the second law of thermodynamics. 15

3059-P-2-Q-9 (25)

[P. T. O.]

Unit-II

4. What do you mean by COP of a refrigerator? Explain in detail the simple refrigeration vapour compression cycle. 15
5. Explain the working of centrifugal and reciprocating pumps. 15

Unit-III

6. Discuss in details the types and functioning of clutches. 15
7. Explain the elastic constants. Also derive the relationship between them. 15

Unit-IV

8. What are the advantages of NC machines? Differentiate NC and CNC machines. 15
9. Explain Manufacturing systems. What are the different components of NC system? 15

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B.Tech. (ME) 3rd Semester (G-Scheme)
Examination, December-2025

THERMODYNAMICS

Paper- PCC-ME-213-G

Time allowed : 3 hours]

[Maximum marks : 75

Note: Attempt any five questions in total, selecting one question from each unit. Question No. 1 is compulsory. All questions carry equal marks.

1. (i) Define Zeroth Law of Thermodynamics.
- (ii) Define Internal energy and enthalpy.
- (iii) Define COP for refrigerator and heat engine.
- (iv) Define carnot cycle.
- (v) What do you mean by entropy?
- (vi) Define critical point for a pure substance.

6×2.5=15

Unit-I

2. Explain first Law of thermodynamics in details for cyclic and non-cyclic processes.
3. Explain the various modes of energy in details. 15

3060-P-2-Q-9 (25)

[P.T.O.]

Unit-II

4. Explain saturation states in details and also explain dry steam, wet steam and superheated steam.
5. Explain the various properties of two phase system- constant temperature and constant pressure heating of water. 15

Unit-III

6. Explain Kelvin-Planck and Clausius statements in details.
7. Explain first law of Thermodynamics in details for flow processes. 15

Unit-IV

8. Explain the following: 15
 - (i) Basic Rankine cycle
 - (ii) Basic Brayton cycle
9. Explain availability function for systems and control volumes for undergoing different processes in details. 15

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**B.Tech. (ME) 3rd Semester (G-Scheme)
Examination, December-2025
ENGINEERING MECHANICS
Paper- ESC-ME-209-G**

Time allowed : 3 hours]

[Maximum marks : 75

Note: Question one is compulsory having six parts and each part is of 2.5 marks total of 15 marks and remaining questions are of 15 marks each. And attempt one question from each section.

1. (a) Free body diagram 15
(b) What is Lami's theorem?
(c) Write the condition of Perfect truss.
(d) What is moment of inertia?
(e) What is rigid body?
(f) Define point of inflection.

Unit-I

2. Given the Couple Moments: $C_1 = 100i+30j+82k$ 1b-ft, $C_2 = -16i+42j$ 1b-ft, $C_3 = 15k$ 1b-ft

What couple will restrain the twisting action of this system about an axis going through?

$$R_1 = 6i+3j+2k \text{ ft to}$$

$$R_2 = 10i-2j+3k \text{ ft}$$

While giving a moment of 100 1b-ft about the x-axis and 50 1b-ft about the y-axis? 15

3073-P-3-Q-9 (25)

[P. T. O.]

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3. (a) Explain the Static equilibrium. 7.5
(b) Discuss the General equations of equilibrium. 7.5

Unit-II

4. Explain the steps involved while making an analysis of a simple truss by the method of joint and method of section. Explain with the help of suitable example of truss. 15
5. Find the M.O.I. of a plate with a circular hole about its centroidal x-axis. 15

Unit-III

6. (a) State and prove the theorem of parallel axis and perpendicular axis. 7.5
(b) Derive an expression for the moment of inertia of a quadrant of a circular plate of radius R. 7.5
7. An Elevator of weight 25 kN is moving vertically downwards with a constant acceleration. Determine the limit of cable tension. Starting from rest, the elevator is stated to travel a distance of 25m during an interval of 8 seconds. What will be the cable tension during this time? 15

Unit-IV

8. Explain the energy and momentum method used in particle dynamics. 15

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9. A beam of span 8.0 m is rested over two simple supports at two ends. The beam is carrying U.D.L. of Intensity 2.0 KN/m upto 4.0 m length from left end. A concentrated load of 5.0 KN at a distance of 6.0 m is applied on the beam. Draw S.F.D. and B.M.D. showing important value. Also find point of Contra flexure. 15

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