

BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

April, 2026 Examinations

Programme: **Engineering & Technology**

Subject: **Engineering Maths-I (GC102)**

Time Duration: **3 Hrs.**

Max. Marks: **75**

Instructions: 1) All questions are compulsory.

2) Figures to the right indicate full marks.

3) Assume suitable additional data if required.

Q.No.1. Answer any five of the following Questions:

5 x 3 = 15

- Find the equation of a circle having centre (3,4) and radius 8 units.
- Solve and comment on the nature of roots of the quadratic equation $x^2+x-8=0$
- Divide the polynomial $2x^3+4x-20$ by $x-2$
- Find arc length and area of sector of a circle having radius 7cm and arc subtends an angle 70° at the centre of the circle.
- Find the volume of a pyramid whose base is a square of side 6cm and the height of the pyramid is 15cm.
- Evaluate $\lim_{x \rightarrow 2} \frac{x^2+3x-10}{x^2-3x+2}$
- Find $\frac{dy}{dx}$ if $y=2x^8+4\log x+7^x$

Q.No.2. Answer any three of the following Questions:

3 x 4 = 12

- Find the perpendicular distance from (4,5) to the line $3x+4y-2=0$
 - Find slope and Y-intercept of the line $2x-3y+4=0$
- Find the equation of a line passing through the point (-2,7) and perpendicular to the line $3x-y+6=0$
- Find the equation of median CD of $\triangle ABC$ with vertices A(8,-2), B(2,-4) and C(1,3)
- Find the acute angle between the lines $5x+y-2=0$ and $2x-y+5=0$
- Find the equation of a circle having centre (2,5) and passing through a point (8,13)

Q.No.3. Answer any three of the following Questions:

3 x 4 = 12

- Find the equation of a circle having diameter the line segment joining (3,6) and (5,2). Hence, find the centre and radius of the circle.
- Find x and y is degrees, if $2x+3y=130^\circ$ and $3x+y=\frac{\pi}{2}^c$
- If $\sin A = \frac{3}{5}$, $\cos B = \frac{-5}{17}$, A and B lies in II quadrant, find $\cos(A+B)$
- Prove that: i) $\tan A + \cot A = \sec A \operatorname{cosec} A$
ii) $\frac{\sin 5\theta - \sin 3\theta}{\cos 5\theta + \cos 3\theta} = \tan \theta$
- Solve the $\triangle ABC$, if $a=12\text{cm}$, $b=8\text{cm}$, $c=10\text{cm}$

Q.No.4. Answer any three of the following Questions:

3 x 4 = 12

- Find x if: $\log^{(x-1)} 2 = 2$ ii) $\log(2x+8) - \log x = 2 \log 2$
- Evaluate: $\lim_{\theta \rightarrow 0} \frac{\cos 10\theta - \cos 4\theta}{\theta^2}$
- Find the volume of frustum of a pyramid whose top and base are equilateral triangles of sides 4cm and 6cm respectively. The height of the frustum is 16cm
- Find the volume and curved surface of frustum of a cone with diameters of top and base as 8cm and 18cm. The height of the frustum is 12cm.

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- e) Find the volume of Simpson's rule, if the areas of cross sections at intervals of 6m are 35, 43, 65, 83, 94, 103 and 115m²

Q.No.5. Answer any three of the following Questions:

3 x 4 = 12

- a) Evaluate: $\lim_{x \rightarrow 0} \frac{(8^x - 1)(e^{3x} - 1) \log(1 + 4x)}{x^3}$
- b) Evaluate: $\lim_{x \rightarrow 4} \left[\frac{1}{x-4} - \frac{x^3}{x^2 - 6x + 8} \right]$
- c) Find the equation of normal to the curve $y = 3x^2 + 2x + 4$ at $(-1, 5)$
- d) Find maxima and minima for the function $y = 2x^3 - 9x^2 + 12x + 5$
- e) The displacement of a particle at time 't' is given by $s = 2t^3 - 6t^2 + 8t + 9$ cm. Find: i) When will the acceleration of the particle become zero? ii) The velocity at that time

Q.No.6. Answer any three of the following Questions:

3 x 4 = 12

- a) Find $\frac{dy}{dx}$, if: i) $y = \sqrt{x} \sin x$ ii) $y = \frac{\cos x}{4x + 3}$
- b) Find $\frac{dy}{dx}$, if $x^6 + 2y^3 + x^4y^2 = 0$
- c) If $y = \sin 4\theta$, $x = \cos 4\theta$, find $\frac{dy}{dx}$
- d) Find $\frac{dy}{dx}$, if: i) $y = \log(\sec x)$ ii) $y = e^{\tan x}$
- e) if $y = (x^3 + 5)^x$, find $\frac{dy}{dx}$

BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

April, 2026 Examinations

Programme: **Engineering & Technology**

Subject: **Applied Physics-I (GC103)**

Time Duration: **3 Hrs.**

Max. Marks: **75**

Instructions: 1) All questions are compulsory.

2) Figures to the right indicate full marks.

3) Assume suitable additional data if required.

Q.No.1. Sub question (a) is compulsory, answer any 7 from the remaining questions:

- a) Give two examples of fundamental unit. (01)
- b) State the principle of homogeneity. (02)
- c) What is meant by banking of roads? (02)
- d) State law of conservation of energy. (02)
- e) Give the relation between linear speed and angular velocity. (02)
Convert 50rpm to rad/sec.
- f) Write any two examples of centripetal force. (02)
- g) Define yield point. (02)
- h) What is streamlined flow? (02)
- i) Define cohesive force. (02)
- j) Define convection. (02)
- k) State the relation between α and β being coefficient of linear and areal expansion. (02)

Q.No.2. Answer any three of the following Questions:

3 x 4 = 12

- a) Check the correctness of the following equation $P = h \rho g$:
where P =pressure, h =height, ρ =density, g =acceleration due to gravity
- b) Write down seven fundamental quantities and their units in the SI system.
- c) Explain positive and negative error in micrometer screw gauge with a neat diagram.
- d) i) Convert 1000 Kg/m^3 in gm/cm^3
ii) State types of errors in measurement
- e) A body of mass 2 Kg is at a height of 40 m above the ground moving with velocity 20 m/s . Calculate its kinetic energy and potential energy.

Q.No.3. Answer any three of the following Questions:

3 x 4 = 12

- a) Define scalar and vector quantities.
- b) Define uniform acceleration. State three points of difference between distance and displacement.
- c) A ball is dropped from the top of a tower which is 120 m high. With what velocity will it hit the ground?
- d) Define: i) One Joule ii) Acceleration due to gravity
- e) An object travels with an initial velocity of 20 m/s and acceleration 4 m/s^2 . Find the distance covered by the object in 10 seconds.

Q.No.4. Answer any three of the following Questions:

3 x 4 = 12

- a) State Newton's law of gravitation. Write the formula for the gravitational force and indicate what each term represents.
- b) Define the following terms: i) Super elevation ii) Periodic time of a satellite
- c) Define escape velocity. Write an expression for escape velocity and indicate what each term in the expression represents.
- d) A mass of 50 Kg rotates in a horizontal circle of radius 5 m at a speed of 8 rpm . Calculate the centripetal force acting towards the centre of the circle.

- e) Calculate the acceleration due to gravity at the earth's surface. Take the earth's radius as $6.4 \times 10^6 \text{ m}$ and earth's mass as $5.98 \times 10^{24} \text{ Kg}$ ($G = 6.67 \times 10^{-11} \text{ Nm}^2/\text{Kg}^2$)

Q.No.5. Answer any three of the following Questions:

3 x 4 = 12

- a) i) State Hooke's law.
ii) Define Bulk modulus.
- b) A steel wire of length 3.14 m and radius of $0.6 \times 10^{-3} \text{ m}$ has its upper end tied to a beam. If a mass of 3 Kg is attached to its lower end, find the extension produced in the wire. Take $Y = 2 \times 10^{11} \text{ N/m}^2$
- c) Define surface tension. Write an expression for surface tension and indicate what each term in the expression represents.
- d) State Newton's law of viscosity. Derive an expression for force of viscosity.
- e) Calculate the viscous force on a spherical body of radius 0.02 m falling through a liquid of viscosity 1.2 Ns/m^2 when its terminal velocity is 0.14 m/s .

Q.No.6. Answer any three of the following Questions:

3 x 4 = 12

- a) Define the following:
i) Terminal velocity
ii) Latent heat of vaporization
- b) State and derive Boyle's law.
- c) A gas occupies a volume of 30 cm^3 at a pressure of 280 mm and a temperature of 27°C . Find its volume at a pressure of 600 mm and a temperature of 57°C .
- d) State the factors on which quantity of heat conducted depends. Write an expression for heat conducted.
- e) A copper rod of 1 m length expands by 0.2 cm when heated from 20°C to 90°C . Calculate the coefficient of linear expansion.

BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

April, 2026 Examinations

Programme: **Engineering & Technology**

Subject: **Applied Chemistry (GC104)**

Time Duration: **3 Hrs.**

Max. Marks: **75**

- Instructions:** 1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Assume suitable additional data if required.

Q.No.1. Answer any five of the following Questions:

5 x 3 = 15

- Define quantum numbers. State the number of sub shells present in second energy shell and give the maximum number of electrons in each sub shell.
- Filling of 4s orbital takes place before 3d orbital, justify the statement.
- Define hard and soft water. Write the reaction for removal of temporary hardness of water by boiling.
- Schematically represent the process of electrolysis of fused NaCl using carbon electrodes.
- Give reasons for following:
i) Small anodic area results in intense localized corrosion
ii) Steel screws in bass marine hardware corrodes
- Define corrosion. Which factors are essential for electrochemical corrosion to take place?
- Define polymer and monomer. Write reaction for polymerization of tetrafluoroethene to polytetrafluoroethene.
- i) Write any one equation for removal of permanent hardness of water by zeolite process
ii) Why electrolytic solution as a whole is always neutral?

Q.No.2. Answer any three of the following Questions:

3 x 4 = 12

- Differentiate between energy level and sub energy level giving four points.
- How ionic bond is formed? Explain the formation of NaCl molecule by electrovalency.
- State Pauli's Exclusion principle. Write the orbital electronic configuration of following elements:
i) Potassium ii) Silicon iii) Nitrogen
- Explain Lewis and Langmuir concept of stable electronic configuration.

Q.No.3. Answer any three of the following Questions:

3 x 4 = 12

- With reference to ion exchange process of water softening:
i) Write one reaction each occurring in cation and anion exchange resin process
ii) Write the reaction for regeneration of exhausted cation exchange resin
iii) Why the water obtained is called deionised water?
- What are the ill effects of using hard water for:
i) Textile and dyeing industry ii) Paper industry
- With the help of diagram, explain the reverse osmosis process for desalination of brackish water.
- i) Give two points of difference between sludge and scale.
ii) Define pH. What is the pH range of strongly acidic and strongly basic solution?

Q.No.4. Answer any three of the following Questions:

3 x 4 = 12

- Define degree of ionization. Explain any three factors affecting degree of ionization.

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- b) In the electrolysis of aqueous CuSO_4 solution using copper electrodes:
 i) Write the ions present in the solution
 ii) Write the reaction at cathode and anode
 iii) Why does the strength of CuSO_4 solution remains the same?
 c) Define electrochemical series? Explain the significance of electrochemical series giving two points.
 d) With the help of diagram, explain the hydrogen evolution mechanism of electrochemical corrosion.

3 x 4 = 12

Q.No.5. Answer any three of the following Questions:

- a) Give four points of difference between galvanizing and tinning.
 b) Explain the following methods of corrosion control by environment modification:
 i) Deaeration ii) Alkaline neutralization
 c) What is the principle cathodic protection? Describe the sacrificial anodic protection method giving a suitable example.
 d) i) Pure metal rod half immersed vertically in water starts corroding from bottom, give reason.
 ii) Name the different types of oxide films formed in oxidation corrosion. In which type of oxide film, corrosion does not occur and why?

Q.No.6. Answer any three of the following Questions:

3 x 4 = 12

- a) What is electroplating? How is the process of electroplating carried out?
 b) Write four points of difference between thermoplastic and thermosetting plastic.
 c) Explain the following properties of synthetic rubber and give their related applications:
 i) Abrasion resistance ii) Elasticity
 d) Define concentration cell corrosion. Explain metal ion concentration cell corrosion.

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BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

April, 2026 Examinations

Programme: **Engineering & Technology**

Subject: **Engineering Maths-II (GC201)**

Time Duration: **3 Hrs.**

Max. Marks: **75**

Instructions: 1) All questions are compulsory.

2) Figures to the right indicate full marks.

3) Assume suitable additional data if required.

Q.No.1. Answer any five of the following Questions:

5 x 3 = 15

- a) Find the values of x, y, z , if $\begin{bmatrix} x+5 & y-3 \\ 6z & 8 \end{bmatrix} = \begin{bmatrix} -5 & -1 \\ 1 & 8 \end{bmatrix}$
- b) If $\begin{vmatrix} 1 & k \\ 2 & 4 \end{vmatrix} = \begin{vmatrix} 4 & 3 \\ 8 & 1 \end{vmatrix}$, find the value of k
- c) Find $|\bar{a} - \bar{b}|$ given $\bar{a} = \hat{i} + 2\hat{j} - \hat{k}$, $\bar{b} = 3\hat{i} - \hat{j} + \hat{k}$
- d) Find $\int (\sin 5x + 6^x - \cot 3x) dx$
- e) Determine if the vectors $\bar{a} = 6\hat{i} - 5\hat{j} + 3\hat{k}$ and $\bar{b} = -4\hat{i} - 3\hat{j} + 3\hat{k}$ are perpendicular to each other.
- f) Evaluate $\int_0^4 e^{2x} dx$
- g) Express the number $Z=1+i$ in its polar form(Only for students of Elex & allied courses)
- g) Obtain the mean, median and mode of:
11, 8, 16, 13, 10, 8(Only for students of Mech. Engg. & allied courses)

Q.No.2. Answer any three of the following Questions:

3 x 4 = 12

- a) Solve using Cramer's Rule: $x+2y+z=4$, $2x-y-z=1$, $x-y+2z=-3$
- b) Find A^{-1} given $A = \begin{bmatrix} 1 & 3 & 3 \\ 1 & 4 & 3 \\ 1 & 3 & 4 \end{bmatrix}$
- c) Solve using Matrix Method: $2x-y=10$, $x+3y=-2$
- d) If $A = \begin{bmatrix} 3 & 2 \\ -1 & -2 \end{bmatrix}$ find $A^2+5A-2I$, where I is the identity matrix.
- e) Given $A = \begin{bmatrix} 1 & 3 \\ 2 & -1 \end{bmatrix}$, show that $A + A^t$ is a symmetric matrix.

Q.No.3. Answer any three of the following Questions:

3 x 4 = 12

- a) $\int \frac{6x^2 + x - 1}{2x - 1} dx$
- b) $\int \frac{1}{x^2 - 12x + 11} dx$
- c) $\int x \cos 2x dx$
- d) $\int \frac{e^x}{e^{2x} + 1} dx$
- e) $\int \frac{(\log x)^5}{x} dx$

Q.No.4. Answer any three of the following Questions:

3 x 4 = 12

- b) Find $\bar{q} \times \bar{r}$ for the vectors $\bar{q} = 2\hat{i} - \hat{j} - \hat{k}$, $\bar{r} = \hat{i} - \hat{j} + \hat{k}$
- c) Calculate the angle between the vectors: i) $\bar{a} = \hat{i} + 4\hat{j} - \hat{k}$ and $\bar{b} = \hat{i} + 2\hat{j} - 3\hat{k}$
- d) If $\bar{a} = 2\hat{i} - 2\hat{j} - \hat{k}$, $\bar{b} = 3\hat{i} + 2\hat{j} + \hat{k}$, $\bar{c} = \hat{i} - \hat{j} - 3\hat{k}$, find the projection of $2\bar{a} - \bar{b}$ on $\bar{c}$
- e) Show that the vectors $\bar{a} = -\hat{i} + 2\hat{j} + 3\hat{k}$, $\bar{b} = 3\hat{i} + \hat{j} - 2\hat{k}$, and $\bar{c} = 2\hat{i} + 3\hat{j} + \hat{k}$, form the sides of an equilateral triangle.

Q.No.5. Answer any three of the following Questions:

3 x 4 = 12

- a) Find $\int \left(\frac{1}{4+5x} + e^{1-6x} + \tan 4x + \sqrt{x} \right) dx$
- b) $\int \frac{1}{\sqrt{2x+1} - \sqrt{2x-1}} dx$
- c) Evaluate $\int_2^5 \frac{\sqrt{x}}{\sqrt{x} + \sqrt{7-x}} dx$
- d) Find the area enclosed by the parabola $x^2 = 4y$ and the lines $x=1$ and $x=3$
- e) Calculate the volume obtained by revolving the area enclosed by $x=8y$, the Y-axis $y=0$, $y=2$ about the Y-axis.

Q.No.6. Answer any three of the following Questions:
(Only for students of Elex. Engg. & allied courses)

3 x 4 = 12

- a) Given $(7-4i) (-2+3i) = a+ib$, find a and b
- b) Simplify $\frac{i^6 + 4i^5}{i^8 + i}$
- c) Use De Moivre's theorem to simplify:
$$\frac{(\cos 8\theta + i \sin 8\theta)^{3/4} (\cos 2\theta + i \sin 2\theta)^3}{\left(\cos \frac{\theta}{2} + i \sin \frac{\theta}{2} \right)^{-8} (\cos 4\theta - i \sin 4\theta)^{5/2}}$$
- d) Express the complex number $Z = -\frac{1}{2} - \frac{1}{2}i$ in its exponential form.
- e) If $Z_1 = 2-3i$, $Z_2 = 4+i$, find: i) $|Z_1 + \bar{Z}_2|$ ii) $4Z_2 - 2Z_1$

Q.No.6. Answer any two of the following Questions:
(Only for students of Mech. Engg. & allied courses)

2 x 6 = 12

- a) Calculate the median and the mode of the weekly income of employees in a certain industry from the following data:

Weekly Income(Rs.)	0-1000	1000-2000	2000-3000	3000-4000	4000-5000	5000-6000
No. of employees	100	190	250	100	50	20

- b) Find the standard deviation for the following distribution giving the lengths of 155 steel rods:

Length (cm)	42	43	44	45	46	47	48	49	50
No. of rods	10	13	12	15	20	23	17	20	25

- c) Calculate the mean deviation for the following data giving the average rainfall on a particular day recorded at 90 places:

Average Rainfall (mm)	20-30	30-40	40-50	50-60	60-70	70-80
No. of Places	14	16	18	20	22	10

BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

April, 2026 Examinations

Programme: **Engineering & Technology**

Subject: **Applied Physics-II (GC202)**

Time Duration: **3 Hrs.**

Max. Marks: **75**

Instructions: 1) All questions are compulsory.

2) Figures to the right indicate full marks.

3) Assume suitable additional data if required.

Q.No.1. Sub question (a) is compulsory. Answer any 7 from (b) to (k):

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|---|------|
| a) State the unit of capacitance. | (01) |
| b) 1000J of work is done in bringing the charge of 4 micro coulomb. Calculate the electric potential. | (02) |
| c) Convert 1KWh to joules. | (02) |
| d) State the law of resistances in parallel. | (02) |
| e) State Lenz's law. | (02) |
| f) What is a step-down transformer? | (02) |
| g) Write the expression for magnetic induction at the centre of a circular coil current carrying conductor. | (02) |
| h) State two important properties of X rays. | (02) |
| i) Define luminous intensity. | (02) |
| j) Write the full form of LASER. | (02) |
| k) Define echo. | (02) |

Q.No.2. Answer any three of the following Questions:

3 x 4 = 12

- State four important properties of electric lines of force.
- Find the electric intensity at a point 0.4m from a charge of 48 micro coulomb placed in a medium of dielectric constant 2.4.
- Obtain an equation for effective capacitance when three capacitors are connected in series.
- Two equal charges of 10 micro coulomb are separated by 0.5m and placed in a medium of dielectric constant 1.5. Calculate the force between them.
- i) How and what resistance must be connected to a 10 ohm resistance so that effective resistance is 25 ohm?
ii) A lamp is marked 200V, 100W. Calculate the amount of current that flow through it.

Q.No.3. Answer any three of the following Questions:

3 x 4 = 12

- Draw a neat circuit diagram for comparing emf of two cells by sum and difference method. Write the equation for comparing emf using this method.
- A wire of length 2m radius 0.15mm has resistance of 10 ohm. Calculate specific resistance of the material of the wire.
- i) State Ohm's law ii) Define EMF
- The emf of a battery is 25V and internal resistance of the cell is 5 ohm. When the external conductor is introduced, the potential difference between them is 15V. Calculate the current flowing through the conductor and its resistance.
- What is heating effect of electric current? Write the expression for heat generated in a current carrying conductor and also what each term in the expression indicates.

Q.No.4. Answer any three of the following Questions:

3 x 4 = 12

- a) Explain self induction with a neat diagram.
- b) A wire carrying current of 4A is 0.6m long. What will be the force acting on it, if it is kept in a magnetic field of strength $5 \times 10^{-2} \text{ Wb/m}^2$ at an angle of 30° to the direction of the field?
- c) i) State Fleming's left hand rule.
ii) Write an expression for emf generated in a coil placed in a magnetic field.
- d) A transformer has 500 primary turns and 2000 secondary turns. The input voltage is 4V and the output current is 2A. Determine: i) Output voltage ii) Input current
- e) Explain magnetic effect of electric current as demonstrated by Oersted's experiment.

Q.No.5. Answer any three of the following Questions:

3 x 4 = 12

- a) What conditions are necessary for total internal reflection? give two examples of total internal reflection.
- b) Two lamps of 12 candela and 48 candela are placed 1.6m apart. Find the position of the point between them, where the illuminance due to the two sources is equal.
- c) Draw a ray diagram showing refraction through a prism. Write an expression for refractive index in minimum deviation position.
- d) Light is travelling from glass to air. Refractive index of glass is 1.5. Find the critical angle.
- e) i) State inverse square law of illumination.
ii) Define critical angle.

Q.No.6. Answer any three of the following Questions:

3 x 4 = 12

- a) Define pitch of a sound. Draw a waveform to represent high pitch and low pitch sound.
- b) Explain free and forced vibrations giving examples of each.
- c) What is piezo electric effect? How are ultrasonic waves produced using piezo electric effect?
- d) Explain how ultrasonic waves are used to find the depth of sea bed.
- e) The brass wire has a resistance of 5 ohm at 0°C . Determine its resistance at 40°C . (Temperature coefficient of copper = $0.0015/^\circ\text{C}$)

BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

April, 2026 Examinations

Programme: **Common**

Subject: **Environmental Studies (GC203)**

Time Duration: **3 Hrs.**

Max. Marks: **75**

Instructions: 1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Assume suitable additional data if required.

Q.No.1. Answer any five of the following Questions:

5 x 3 = 15

- Explain the importance of Environmental Studies.
- What is the aesthetic value of biodiversity?
- Give any two examples of water conflict in India.
- State the causes of land degradation.
- Why is it necessary to separate dry and wet waste?
- List the major sources of noise pollution.
- State the objectives of Environment Protection Act.

Q.No.2. Answer any two of the following Questions:

2 x 6 = 12

- What is sustainable development? State any five guidelines for sustainable development.
- Write a note on environmental audit.
- Discuss the need for women and child welfare and name any four schemes of the Government for women and child welfare.

Q.No.3. Answer any two of the following Questions:

2 x 6 = 12

- With suitable examples explain food chain and food web.
- Draw and explain: i) Pyramid of number for grassland ecosystem ii) Pyramid of biomass for pond ecosystem
- Discuss the various threats to biodiversity.

Q.No.4. Answer any two of the following Questions:

2 x 6 = 12

- Discuss the causes and effects of deforestation.
- Explain the effects of mining activities on the environment.
- What are non-renewable sources of energy? Discuss any two alternate sources of energy in use.

Q.No.5. Answer any two of the following Questions:

2 x 6 = 12

- What is acid rain? State its causes and effects.
- Draw the flow sheet diagrams of primary and secondary treatment of waste water.
- What is radioactive waste? Write a note on hazards of exposure to radioactive waste.

Q.No.6. Answer any two of the following Questions:

2 x 6 = 12

- Discuss the effects of air pollution on human health.
- State the objectives of the following Acts:
i) Wildlife Protection Act ii) Forest Conservation Act
- Explain the role you will play in educating the people in your locality to prevent different types of pollution.

BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

April, 2026 Examinations

Programme: **Common**

Subject: **Engineering Materials (GC205)**

Time Duration: **3 Hrs.**

Max. Marks: **75**

Instructions: 1) All questions are compulsory.

2) Figures to the right indicate full marks.

3) Assume suitable additional data if required.

Q.No.1. Answer any five of the following Questions:

5 x 3 = 15

- Explain briefly the following physical properties of materials:
i) Melting point ii) Boiling point or freezing point
iii) Coefficient of linear expansion
- Enlist any five differences between ferrous and non ferrous metals.
- List the properties of aluminium that makes it a useful engineering metal. Also mention the various alloys of aluminium.
- What is cement? Give the main ingredients of cement.
- Give the various functions of lubricants. What are the types of lubricants?
- Give characteristics of solid insulating materials.

Q.No.2. Answer any two of the following Questions:

2 x 6 = 12

- Explain any four mechanical properties of the engineering materials.
- List the types of cast iron and give their properties and uses.
- What is meant by chemical properties of engineering materials? Elaborate.

Q.No.3. Answer any two of the following Questions:

2 x 6 = 12

- What are tool steels? Give its composition, properties and uses.
- State classification and properties of bricks.
- What are the desirable properties of refractories? Give their applications.

Q.No.4. Answer any two of the following Questions:

2 x 6 = 12

- Discuss the important characteristics of clay. List down the products of clay.
- Write short note on: i) Fibre glass ii) Glass wool iii) Abrasives
- Explain the various constituents of paints.

Q.No.5. Answer any two of the following Questions:

2 x 6 = 12

- Explain the following:
i) Dielectric strength ii) Electrical resistivity iii) Permeability
- State and explain properties and applications of any three high conductivity materials.
- State the specifications and uses of the following semiconductor materials: i) Silicon ii) Germanium

Q.No.6. Write short note on any three:

3 x 4 = 12

- Lead and its hazard to the environment
- Oil based and polymer based paints
- Diamagnetic, paramagnetic and ferromagnetic materials
- Common building stones and their applications
- Insulating materials

BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

April, 2026 Examinations

Programme: **Electrical Engg.**

Subject: **Circuit Theory (EL301)**

Time Duration: **3 Hrs.**

Max. Marks: **75**

Instructions: 1) All questions are compulsory.

2) Figures to the right indicate full marks.

3) Assume suitable additional data if required.

Q.No.1. Answer any five of the following Questions:

5 x 3 = 15

- Find the equivalent resistance between A and B of the circuit shown in fig.1(a)
- Define: i) Bilateral element ii) Linear circuit iii) Branch of circuit
- Draw power triangle and write equation of apparent power, active power and reactive power.
- Draw star connected balanced load diagram and write relationship between line and phase voltage.
- Write equation of Q factor and bandwidth for series resonant circuit.
- Define unbalanced system. (3 phase)

Q.No.2. Answer any two of the following Questions:

2 x 6 = 12

- For the circuit shown in fig.2(a) find the current through $R_L = 12\Omega$ using Thevenin's theorem.
- Use superposition theorem, to find current through 1Ω resistor. All resistance are in ohms. [refer fig.2(b)]
- Use mesh analysis for fig.2(c) to find current through 8Ω

Q.No.3. Answer any two of the following Questions:

2 x 6 = 12

- Impedances, $Z_1 = (5 + j10)\Omega$ and $Z_2 = (4 + j16)\Omega$ are connected in parallel. If the total current supplied is 20A, what is the power taken by each branch?
- Three impedances $Z_1 = (2 + j4)\Omega$, $Z_2 = 6 - j8\Omega$, $Z_3 = (4 + j0)\Omega$ are connected in series across a 100V, 50Hz supply. Calculate: i) Current ii) Voltage drops V_1 , V_2 , V_3 iii) Power absorbed by each impedance
- A current of 10A flows through a non-inductive resistance in series with a choking coil, when supplied at 250V, 50Hz. If the voltage across the resistance is 125V and across the choke is 200V, calculate impedance, reactance and resistance of the coil. Also calculate power absorbed by coil.

Q.No.4. Answer any two of the following Questions:

2 x 6 = 12

- Three similar coils, each having a resistance of 20 ohms and an inductance of 0.05H are connected in delta connection, to a 3 phase, 400V, 50Hz ac supply. Calculate total power and line current.
- Derive the relationship between line and phase current for delta connected balanced load.
- Each phase of a star connected load consists of a resistor 8Ω and inductance of 6H. The supply is 400V, 50Hz a.c supply. Calculate line current, power factor and total power.

Q.No.5. Answer any two of the following Questions:

2 x 6 = 12

- A series R-L-C circuit consists of a resistance of 10Ω , inductance of 0.2H and capacitance of $40\mu F$. A voltage of 100V is applied to this circuit. Find: i) Resonant frequency ii) Current at resonance iii) Power factor at resonance iv) Power at resonance

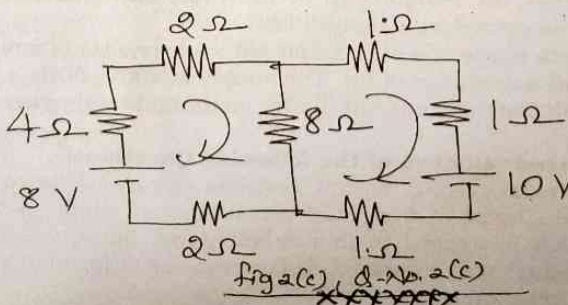
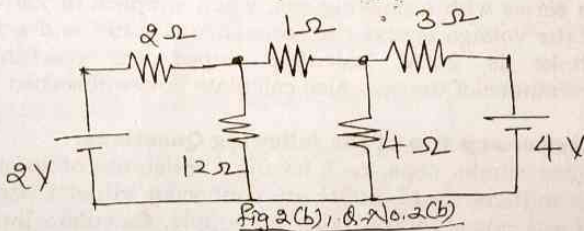
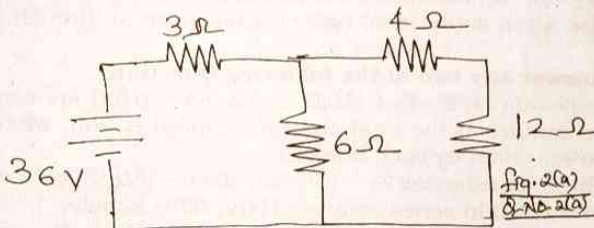
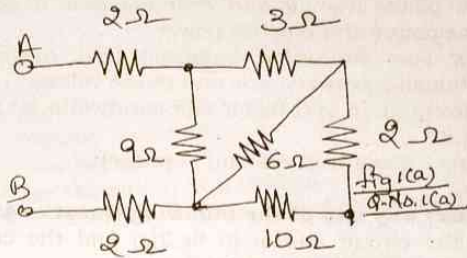
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- b) Draw the graphical representation for variation of conductance, admittance, inductive susceptance, capacitive susceptance and current with frequency for a.c parallel R-L-C circuit and explain.
- c) An inductive circuit of resistance 2Ω and inductance $0.02H$ is connected to a $250V, 50Hz$ supply. What capacitance placed in parallel will produce resonance? Find total current taken from the supply.

Q.No.6. Answer any two of the following Questions:

2 x 6 = 12

- a) Find out the positive, negative and zero sequence components of the following set of three unbalanced voltage vectors: i) $V_A = 10\angle 30^\circ$ ii) $V_B = 30\angle -60^\circ$ iii) $V_C = 15\angle 145^\circ$
- b) Calculate the values of the positive, negative and zero phase sequence components of the following set of unbalanced currents: i) $I_R = 100\angle 30^\circ$ ii) $I_Y = 50\angle 300^\circ$ iii) $I_B = 30\angle 180^\circ$
- c) The current in a circuit given by $(4.5 + j12)$ when applied voltage is $(100 + j150)$. Calculate the power and phase angle between current and voltage.



BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

April, 2026 Examinations

Programme: **Electrical Engg./E&EE**

Subject: **Electrical Machines-I (EL302)**

Time Duration: **3 Hrs.**

Max. Marks: **75**

Instructions: 1) All questions are compulsory.

2) Figures to the right indicate full marks.

3) Assume suitable additional data if required.

Q.No.1. Answer any five of the following Questions:

5 x 3 = 15

- List any two applications of following DC motors:
i) DC series motor ii) DC shunt motor iii) DC cumulative compound motor
- Draw a neat labeled equivalent circuit of transformer referred to primary.
- List any three methods to reduce leakage flux in the transformer.
- Explain the significance of back emf in DC motors.
- List the necessary conditions for the successful parallel operation of transformers.
- What is voltage regulation of transformer? Voltage regulation of transformer should be high or low? Explain why?

Q.No.2. Answer any two of the following Questions:

2 x 6 = 12

- With a neat characteristic curve explain voltage build up process in a DC shunt generator.
- Draw a neat labelled connection diagram of a:
i) DC shunt generator ii) DC series generator iii) Cumulative compound DC generator
Write the equations for voltage and armature current for each of the above generators.
- State six points of comparison between lap winding and wave winding.

Q.No.3. Answer any two of the following Questions:

2 x 6 = 12

- With a neat diagram explain any three field control methods of a speed control of DC series motor.
- Draw and explain speed-torque characteristics for:
i) DC shunt motor ii) DC series motor iii) DC cumulative compound motor
- With a neat diagram explain working of a four point starter.

Q.No.4. Answer any two of the following Questions:

2 x 6 = 12

- What is the necessity of cooling in transformer? List and explain any four types of cooling methods used in transformer.
- Draw a neat labeled phasor diagram of a transformer on inductive load and explain the same.
- A 6600V/230V, 50Hz, single phase core type transformer has a core section of 25cm x 25cm. Calculate the approximate number of primary and secondary turns if the flux density in the core equals to 1.1 Wb/m².

Q.No.5. Answer any two of the following Questions:

2 x 6 = 12

- The primary and secondary windings of a 40KVA, 6600/250V, single phase transformer have resistance of 10Ω and 0.02Ω respectively. The total leakage reactance is 35Ω as referred to primary winding. Find full load voltage regulation at a power factor of 0.8 lagging.
- With a neat diagram explain in detail short circuit test on transformer and its relevant calculations.

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- c) A 100KVA distribution transformer supplying light and fan loads has full load copper loss and core loss of 1.5KW and 2KW respectively. During 24 hours in a day, transformer is loaded as follows:

6 am to 10 am (4 hours) = half load

10 am to 6 pm (8 hours) = one fourth load

6 pm to 10 pm (4 hours) = full load

10 pm to 6 am (8 hours) = negligible load

Calculate all day efficiency of the transformer

Q.No.6. Answer any two of the following Questions:

2 x 6 = 12

- State six points of comparison between auto transformer and two winding transformer.
- Write short note on constructional features of high frequency transformer.
- State the functions of following parts of transformer:
i) Breather ii) Buchholz relay iii) Core iv) Tap changer

BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

April, 2026 Examinations

Programme: **Electrical Engg/E&EE**

Subject: **Electrical Measurement & Instruments (EL303)**

Time Duration: **3 Hrs.**

Max. Marks: **75**

Instructions: 1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Assume suitable additional data if required.

Q.No.1. Answer any five of the following Questions:

5 x 3 = 15

- Define: i)Sensitivity ii)Accuracy iii)Precision, with respect to measuring instruments.
- Explain the importance of damping torque in analog indicating instruments. List the methods used for providing damping torque.
- State any two advantages and disadvantages of Moving Iron (MI) type of instruments.
- PMMC instruments cannot be used for AC measurements, state true or false. Justify with reasons.
- Explain briefly the error due to connection in Wattmeter.
- Briefly explain the working principle of dynamometer type of Wattmeter.
- Name the instrument you will recommend for measurement of low resistance values. Justify your choice.

Q.No.2. Answer any two of the following Questions:

2 x 6 = 12

- State the classification of measuring instruments. Write example of each type. Briefly explain any two types of instruments.
- State the necessity of providing controlling torque in an analog indicating type of measuring instrument. List the methods of producing controlling torque. Explain any one method.
- Write a short note on 'classification of errors in measurement and the necessity of minimizing errors'.

Q.No.3. Answer any two of the following Questions:

2 x 6 = 12

- With a neat labeled diagram explain the construction and working of PMMC type of measuring instruments.
- State the need of extension of range of Voltmeter. List the methods for extension of range of Voltmeter. Explain any one method with neat diagram.
- With the help of neat circuit diagram explain the concept and working of rectifier type of instrument using full wave rectifier. State its advantages.

Q.No.4. Answer any two of the following Questions:

2 x 6 = 12

- With neat diagram explain the construction and working principle of single phase induction type energy meter.
- Draw necessary diagram and explain the method of extension of low range Wattmeter using CT and PT for measurement of three phase power by two Wattmeter method.
- A 3 ϕ , 415V motor load has two Wattmeter connected for measuring the input power. The sum of the two Wattmeter is 25KW. Find the reading of each Wattmeter for following cases when: i)The load power factor is 0.45 ii)The load power factor is unity

Q.No.5. Answer any two of the following Questions:

2 x 6 = 12

- a) Draw the block diagram of electronic energy meter and explain its concept.
- b) With neat circuit diagram explain the principle and method of measurement of low resistance using a Kelvin's double bridge.
- c) Draw circuit diagram and explain the construction and working principle of a series type Ohmmeter.

Q.No.6. Answer any two of the following Questions:

2 x 6 = 12

- a) With the help of neat diagram explain the construction and principle of power factor measurement using 1Ø electro dynamometer type of power factor meter.
- b) Write short note on construction and working of Megger.
- c) Explain the construction and operation of vibrating reed type frequency meter.

BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

April, 2026 Examinations

Programme: **Electrical Engg.**

Subject: **Generation & Transmission of Electrical Energy (EL304)**

Time Duration: **3 Hrs.**

Max. Marks: **75**

Instructions: 1) All questions are compulsory.

2) Figures to the right indicate full marks.

3) Assume suitable additional data if required.

Q.No.1. Answer any five of the following Questions:

5 x 3 = 15

- What is the function of surge tank in hydro power generation?
- Why is exhaust system provided in diesel power plants?
- Define i) Average demand ii) Load factor
- Briefly explain difference between single circuit tower and double circuit tower.
- State use of stay insulator.
- What is transposition of lines? Why it is necessary?
- What is sag? State its importance.

Q.No.2. Answer any two of the following Questions:

2 x 6 = 12

- Draw schematic diagram of thermal power plant. List the main components and state their functions.
- Draw schematic diagram of nuclear power plant. List the main components and state their function.
- Draw schematic diagram of solar electric power generation. List its main components and state their functions.

Q.No.3. Answer any two of the following Questions:

2 x 6 = 12

- Briefly explain the concept of base load power plant and peak load power plant. State one example of each.
- Explain following terms: i) Cold reserve ii) Spinning reserve
- A residential consumer has following load:
i) From mid night to 5 am = 40W
ii) From 5 am to 6 pm = no load
iii) From 6 pm to 7 pm = 320W
iv) From 7 pm to 9 pm = 360W
v) From 9 pm to midnight = 160W
Plot load curve and find average load, maximum load, load factor and energy consumption during the day.

Q.No.4. Answer any two of the following Questions:

2 x 6 = 12

- Compare pin type insulator with disc type insulator.
- Explain advantages and limitations of extra high voltage transmission.
- Explain causes of failures of insulator.

Q.No.5. Answer any two of the following Questions:

2 x 6 = 12

- Briefly explain the following:
i) Efficiency of transmission line
ii) Voltage regulation of transmission line
- A single phase line has two parallel conductors 3m apart. The radius of each conductor is 3cm. Calculate the inductance and capacitance of the line per Km.
- A sort three phase transmission line has line resistance of 0.4 ohm and loop reactance of 0.4 ohm. It is delivering a power of 2000KVA to a load at a pf of 0.8 lagging at the receiving end of the transmission line. If the load voltage is 3000V, determine the voltage regulation and efficiency of line.

Q.No.6. Answer any two of the following Questions:

2 x 6 = 12

- a) Briefly explain the process of erecting a transmission line.
- b) What are line supports? List them and state one advantage and one disadvantage of each.
- c) Draw basic block diagram and explain working of wind electric power generation.

BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

April, 2026 Examinations

Programme: **Electronics Engg./EC/EI/COMP/E/E&EE**

Subject: **Digital Electronics (CC309)**

Time Duration: **3 Hrs.**

Max. Marks: **75**

Instructions: 1) All questions are compulsory.

2) Figures to the right indicate full marks.

3) Assume suitable additional data if required.

Q.No.1. Answer any five of the following Questions:

5 x 3 = 15

- Compare analog signal and digital signal.
- How gray codes are different from binary number, give example.
- State Boolean algebra laws.
- Draw circuit diagram of Half Adder and Half Subtractor.
- Explain in brief about race condition of JK flip flop.
- Draw symbol and truth table of T flip flop.
- What do you mean by EPROM and EEPROM?
- Draw symbol of JK flip flop and write its truth table.

Q.No.2. Answer any two of the following Questions:

2 x 6 = 12

- Convert the following:
i) $[1101\ 0110\ 0011]_2 = (\quad)_{16}$ ii) $[123]_{10} = (\quad)_{BCD}$
iii) $[1001]_{Gray} = (\quad)_2$
- Perform following binary addition:
i) $(+30)_{10}$ and $(-20)_{10}$ ii) $(-30)_{10}$ and $(-20)_{10}$
- i) Explain in brief about ASCII code.
ii) Convert $(1000)_2 = (\quad)_{Gray}$

Q.No.3. Answer any two of the following Questions:

2 x 6 = 12

- Explain NOR gate as universal gate.
- Solve the following by K-map:
 $X = B\bar{C}\bar{D} + \bar{A}B\bar{C}D + AB\bar{C}D + \bar{A}BCD + ABCD$
- Explain Demorgan's theorems.

Q.No.4. Answer any two of the following Questions:

2 x 6 = 12

- Explain the working of full subtractor with neat diagram and truth table.
- Explain working of synchronous 4 bit up counter. Draw timing diagram.
- Explain Mod-10 counter with timing diagram.

Q.No.5. Answer any two of the following Questions:

2 x 6 = 12

- Draw symbol, truth table of D flip flop and explain it.
- Explain operation of RS flipflop with its diagram and truth table.
- Explain SIPO shift register with timing diagram.

Q.No.6. Answer any two of the following Questions:

2 x 6 = 12

- Explain asynchronous 4 bit down counter with neat diagram. Also draw timing diagram.
- Explain R-2R binary ladder DAC.
- Explain operation of successive approximation register ADC.

BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

April, 2026 Examinations

Programme: **Electrical Engg./E&EE**

Subject: **Electrical Machines-II (EL401)**

Time Duration: **3 Hrs.**

Max. Marks: **75**

- Instructions: 1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Assume suitable additional data if required.

Q.No.1. Answer any five of the following Questions:

5 x 3 = 15

- State formula for induction motor showing relationship between:
i) Starting torque and full load torque
ii) Starting torque and maximum torque
- State any two advantages and one disadvantage of DOL starter.
- What is coil span factor? Can it be greater than 1?
- Explain principle of operation of synchronous motor.
- Write final torque equation and power equation for synchronous motor.
- Why we need synchronization of alternators? Briefly explain.
- State applications of: i) Repulsion motor ii) Stepper motor

Q.No.2. Answer any two of the following Questions:

2 x 6 = 12

- Explain working principle of induction motor.
- Explain with diagram torque speed characteristics for an induction motor. Also show change in characteristics for variable rotor resistance.
- A 6-pole induction motor is supplied from a 400V, 3-phase, 50Hz supply. The frequency of rotor induced emf is 2Hz. Calculate: i) The percentage slip ii) The rotor speed

Q.No.3. Answer any two of the following Questions:

2 x 6 = 12

- With the help of diagram explain working of an auto-transformer starter.
- Explain the concept of soft starter. State its advantages.
- The power input to a 415V, 50Hz, 6-pole, 3-phase squirrel cage induction motor running at 975rpm is 40KW. The stator losses are 1000W, the friction and windage losses are 2KW. Calculate:
i) Rotor copper loss ii) Output power developed by the motor
iii) The efficiency of motor

Q.No.4. Answer any two of the following Questions:

2 x 6 = 12

- With a neat diagram explain basic construction and working of an alternator.
- Explain Y curves of synchronous motor.
- A three phase, 50Hz, Y connected 2MVA alternator with rated voltage 2300V gives a short circuit current of 600A and open circuit voltage of 900V for the same excitation current. The armature resistance per phase is 0.9 Ohm. Find the regulation of alternator at full load and operating at: i) Unity power factor ii) pf of 0.8 lagging

Q.No.5. Answer any two of the following Questions:

2 x 6 = 12

- State and explain in brief the advantages of stationery armature and rotating magnetic field.
- With the help of vector diagrams explain armature reaction on an alternator and the effect of load power factor on it.

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- c) A 3-phase, 8-pole, 750rpm, Y connected alternator has 72 slots on the armature. Each slot has 12 conductors and winding is chorded by 2 slots. If the flux per pole is 0.06Wb, find the induced emf between lines.

Q.No.6. Answer any two of the following Questions:

2 x 6 = 12

- a) With a neat diagram explain construction and working of capacitor start and capacitor run single phase induction motor.
- b) With the neat diagram explain working of universal motor. State its application.
- c) With the neat diagram explain construction and working of servo motor. State its application.

BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

April, 2026 Examinations

Programme: **Electrical Engg./E&EE**

Subject: **Applied & Integrated Electronics (EL402)**

Time Duration: **3 Hrs.**

Max. Marks: **75**

Instructions: 1) All questions are compulsory.

2) Figures to the right indicate full marks.

3) Assume suitable additional data if required.

Q.No.1. Answer any five of the following Questions:

5 x 3 = 15

- Draw VI characteristics and symbol of photodiode.
- Explain zener breakdown w.r.t zener diodes.
- What is the need of biasing a transistor?
- What are power amplifiers? Give their classification.
- Explain concept of tank circuit.
- List characteristics of ideal op-amp.
- Draw circuit diagram of op-amp as differentiator. Sketch output waveform if the input waveform is sine wave.

Q.No.2. Answer any two of the following Questions:

2 x 6 = 12

- Explain the working of bridge rectifier circuit. Draw neat diagrams and waveforms.
- Explain working principle of LED's. Draw its symbol. List some applications.
- Draw emitter stabilized bias circuit. Derive its Q point. What are its merits? What is the problem with the circuit?

Q.No.3. Answer any two of the following Questions:

2 x 6 = 12

- Draw and explain working of transistor as a switch.
- Compare between common base, common emitter, common collector configuration.
- What is the need of multi-stage amplifiers? List different types of coupling used. Draw and explain any one of them.

Q.No.4. Answer any two of the following Questions:

2 x 6 = 12

- Explain working of RC phase shift oscillator, write expression of oscillation frequency. Draw relevant diagrams.
- Explain tuned collector oscillator. What are the limitations of LC and RC oscillators?
- List practical characteristics of op-amp IC 74/C. Define CMRR, input bias current and input offset voltage.

Q.No.5. Answer any two of the following Questions:

2 x 6 = 12

- Draw and explain block diagram of op-amp.
- Derive the equation for gain with feedback for op-amp as inverting amplifier. Draw neat diagram.
- Draw circuit diagram of op-amp as integrator. Derive equation of output voltage. Sketch output waveforms if input wave is sine and square wave.

Q.No.6. Answer any two of the following Questions:

2 x 6 = 12

- Explain the working of transformer coupled class A power amplifier with neat circuit diagram.
- Explain how op-amp can be configured as subtractor. Draw neat diagram. Derive its output voltage equation.
- Explain the working of IC555 as astable multivibrator. Draw neat diagrams.

BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

April, 2026 Examinations

Programme: **Electrical Engg./E&EE**

Subject: **Electronic Instrumentation Systems (EL404)**

Time Duration: **3 Hrs.**

Max. Marks: **75**

Instructions: 1) All questions are compulsory.

2) Figures to the right indicate full marks.

3) Assume suitable additional data if required.

Q.No.1. Answer any five of the following Questions:

5 x 3 = 15

- List any three characteristics of an ideal transducer.
- Explain the principle of operation of piezoelectric transducer.
- List any two advantages of electromagnetic flowmeter.
- Explain the principle of operation of piezoelectric accelerometer.
- List any three advantages and disadvantages of LED display.
- Elaborate on the need for signal conditioning.
- List any three applications of SCADA system.

Q.No.2. Answer any two of the following Questions:

2 x 6 = 12

- Draw the block diagram of an instrumentation system and explain the function of each block.
- Define transducer. Explain the classification of transducers giving an example of each.
- With the help of a neat labeled diagram explain the working of turbine flowmeter.

Q.No.3. Answer any two of the following Questions:

2 x 6 = 12

- Differentiate between photodiode and photo transistor.
- Explain the construction, operation and characteristics of RTD. Draw the necessary diagrams.
- Elaborate on how capacitive transducer attains variation in capacitance by: i) Varying of distance ii) Varying of area

Q.No.4. Answer any two of the following Questions:

2 x 6 = 12

- With the help of a neat diagram explain angular speed measurement using magnetic pick up.
- Explain how strain gauge can be used for measurement of differential pressure.
- Explain level measurement using float operated level sensor.

Q.No.5. Answer any two of the following Questions:

2 x 6 = 12

- With a neat diagram explain the working of X-Y plotter.
- Differentiate between low pass, high pass and band pass filters.
- With the help of a diagram elaborate on the working of strip chart recorder.

Q.No.6. Answer any two of the following Questions:

2 x 6 = 12

- Draw neat block diagram of process control system and explain it. Also list its applications.
- With the help of a neat block diagram explain the data acquisition system.
- With the aid of a diagram explain the operation of shaft encoder.

BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

April, 2026 Examinations

Programme: **Electrical Engg.**

Subject: **Distribution & Utilisation of Electrical Energy (EL407)**

Time Duration: **3 Hrs.**

Max. Marks: **75**

Instructions: 1) All questions are compulsory.

2) Figures to the right indicate full marks.

3) Assume suitable additional data if required.

Q.No.1. Answer any five of the following Questions:

5 x 3 = 15

- Give three points of comparison between overhead and underground distribution system.
- Explain in brief importance of earthing.
- State any three advantages and three advantages of concealed conduit wiring.
- State any six advantages off electric heating.
- Explain conduction and convention mode of heat transfer.
- List six requirements of electric traction motors.
- Define the terms: i) Illumination ii) Maintenance factor iii)Utilization factor

Q.No.2. Answer any two of the following Questions:

2 x 6 = 12

- Give six points of comparison between single phase and three phase distribution system.
- Derive an expression for volume of conductor material required for AC, three phase, 4-wire system.
- Draw a neat diagram and explain radial and inter connected system.

Q.No.3. Answer any two of the following Questions:

2 x 6 = 12

- Write short note on rural electrification using ABC system. List its advantages and limitations.
- With the help of neat diagram explain plate earthing.
- Explain in brief 'surface conduit wiring system'. State its advantages and disadvantages.

Q.No.4. Answer any two of the following Questions:

2 x 6 = 12

- With neat diagram explain the working of Ajax Wyatt vertical core furnace. State any two of its advantages and disadvantages.
- With the help of neat diagram explain indirect arc furnace.
- Explain principle of infrared heating. State its advantages and applications.

Q.No.5. Answer any two of the following Questions:

2 x 6 = 12

- Explain in brief trolley collector and pantograph collector.
- draw and explain speed-time curves for:
i)Mainline service ii) Sub urban service
- Compare AC welding with DC welding. (six points)

Q.No.6. Answer any two of the following Questions:

2 x 6 = 12

- With the help of neat diagram explain the working of HPMV lamp.
- Explain in detail stroboscopic effect while using artificial lighting. How this effect can be minimized?
- Explain the working principle of high frequency eddy current heating. State its applications.

BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

April, 2026 Examinations

Programme: **Electrical Engg./E&EE/FT/FT&EE**

Subject: **Elements of Mechanical Engineering (CC307)**

Time Duration: **3 Hrs.**

Max. Marks: **75**

Instructions: 1) All questions are compulsory.

2) Figures to the right indicate full marks.

3) Assume suitable additional data if required.

Q.No.1. Answer any five of the following Questions:

5 x 3 = 15

- What is a compound gear train?
- What is the function of bearing?
- What is meant by stroke volume of engine?
- Write a short note on IBR.
- Differentiate between Air conditioning and Refrigeration.
- List various maintenance tools used for maintenance of mechanical equipment.
- What is meant by discharge of a pump?
- What is the difference between condenser and evaporator in refrigeration?

Q.No.2. Answer any two of the following Questions:

2 x 6 = 12

- With the help of a neat sketch explain construction and working of bush pin type flexible coupling.
- Explain various types of roller bearing and state application of each type.
- Explain following terminologies related to gears:
i) Gear ratio ii) Module iii) Spur gear

Q.No.3. Answer any two of the following Questions:

2 x 6 = 12

- Explain in detail, each stroke of a 4 stroke diesel engine.
- Differentiate between 2 stroke and 4 stroke engine.
- With the help of a neat sketch, explain working of a 2 stroke petrol engine.

Q.No.4. Answer any two of the following Questions:

2 x 6 = 12

- With a neat sketch explain construction and working of Cochran boiler.
- Differentiate between water tube and fire tube boiler.
- With a neat sketch explain construction and working of a reciprocating pump.

Q.No.5. Answer any two of the following Questions:

2 x 6 = 12

- List various boiler mounting and accessories and state their function in short.
- With a neat sketch explain working of split air conditioner.
- Write short note on following:
i) Refrigerant ii) Unit of refrigeration iii) C.O.P

Q.No.6. Write short note on any three:

3 x 4 = 12

- Chain pulley block
- Grease cup lubrication
- Prevention maintenance
- Compression ratio of I.C. engine

BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

April, 2026 Examinations

Programme: **Electrical Engg./E&EE**

Subject: **Switchgear & Protection (EL501)**

Time Duration: **3 Hrs.**

Max. Marks: **75**

Instructions: 1) All questions are compulsory.

2) Figures to the right indicate full marks.

3) Assume suitable additional data if required.

Q.No.1. Answer any five of the following Questions:

5 x 3 = 15

- State three points of comparison between symmetrical and unsymmetrical faults.
- Define following terms: i)Fusing current ii)Total operating time of fuse
- Explain the concept of differential protection.
- Define following terms related to circuit breakers:
i)Arc voltage ii)Restriking voltage iii)Recovery voltage
- List and explain fundamental requirements of protective relays.
- Draw a neat diagram and explain trip circuit of relay and circuit breaker.

Q.No.2. Answer any two of the following Questions:

2 x 6 = 12

- A 3 phase, 11KV, 5000KVA generator has steady state reactance of 20%. It is connected to a 3000KVA transformer having 5% leakage reactance and a ratio of 11/33KV. The 33KV side is connected to a transmission line. A 3 phase fault occurs at the end of the transmission line. The series reactance between the faulted point and the transformer is 30Ω. Calculate the fault current and fault MVA using P.U method.
- What is a current limiting reactors? List the advantages of current limiting reactors. Draw a neat labeled diagram of:
i)Generator reactors ii)Feeder reactors iii) Ring type bus bar reactors
- State six points of comparison between rewirable fuse and HRC fuse.

Q.No.3. Answer any two of the following Questions:

2 x 6 = 12

- List and explain various methods of arc extinction in DC circuit breakers.
- With a neat diagram explain construction and working of ELCB.
- State six points of comparison between fuse and circuit breakers.

Q.No.4. Answer any two of the following Questions:

2 x 6 = 12

- With a neat diagram explain construction and working of vacuum circuit breakers.
- State advantages and disadvantages of SF6 circuit breakers.
- With a neat diagram explain working of HVDC circuit breakers.

Q.No.5. Answer any two of the following Questions:

2 x 6 = 12

- With a neat diagram explain construction and working of:
i)Solenoid type relay ii)Bimetallic relay
- With a neat block diagram explain instantaneous static over current relay.
- With a neat diagram explain construction and working of reverse power relay.

Q.No.6. Answer any two of the following Questions:

- a) With a neat diagram explain biased differential protection for star-delta connected 3 phase transformer.
- b) With a neat diagram explain earth leakage protection of busbars.
- c) With a neat diagram explain time graded protection using inverse time relays. State its advantages.

BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

April, 2026 Examinations

Programme: **Electrical Engg./E&EE**

Subject: **Power Electronics & Drive Control (EL502)**

Time Duration: **3 Hrs.**

Max. Marks: **75**

- Instructions: 1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Assume suitable additional data if required.

Q.No.1. Answer any five of the following Questions:

5 x 3 = 15

- Draw the symbol for IGBT. Also state its function and application.
- Using the necessary circuit diagram and waveforms state the principle of operation for ON-OFF control in AC voltage controllers.
- What is SMPS? Draw a neat labeled block diagram of SMPS.
- What is an inverter? List any two applications of inverter.
- What are choppers? Classify them.
- What are cycloconverters? List the types of cycloconverters.
- Draw the block diagram of an electric drive system using power electronic converter.
- List the methods of speed control for AC motors.

Q.No.2. Answer any two of the following Questions:

2 x 6 = 12

- Draw a neat and labeled V-I characteristics of silicon controlled rectifier. Also define holding current and latching current.
- List the various turn ON methods of SCR. Explain any one in detail.
- Elaborate on di/dt and dv/dt protection in SCR.

Q.No.3. Answer any two of the following Questions:

2 x 6 = 12

- With a neat circuit diagram and waveforms explain single phase half wave converter with resistive load.
- Draw the circuit diagram and waveforms for three phase full wave converter.
- Explain the operation of single phase full wave controller with 'R' load. Draw the necessary circuit diagram and waveforms.

Q.No.4. Answer any two of the following Questions:

2 x 6 = 12

- With the help of neat circuit diagram explain the working of boost regulator.
- Using neat circuit diagram and waveforms, explain F/3 generating cycloconverter with centre tapped configuration.
- What is meant by commutation in SCR? List the types of commutation and explain any one in detail.

Q.No.5. Answer any two of the following Questions:

2 x 6 = 12

- With a neat diagram explain the working of modified series inverter.
- Explain class B chopper in detail. Draw the required diagram and waveforms.
- Write a short note on static Kramer's drive.

Q.No.6. Answer any two of the following Questions:

2 x 6 = 12

- With a neat diagram explain two quadrant chopper drive.
- Write a short note on VFD.
- Explain static rotor resistance control using chopper.

BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

April, 2026 Examinations

Programme: **Electrical Engg./E&EE**

Subject: **Electrical Drives (EL601)**

Time Duration: **3 Hrs.**

Max. Marks: **75**

Instructions: 1) All questions are compulsory.

2) Figures to the right indicate full marks.

3) Assume suitable additional data if required.

Q.No.1. Answer any five of the following Questions:

5 x 3 = 15

- With a neat diagram explain what is an electric drive.
- If a hoist is coming down, in which region the drive motor should operate? Why?
- State two advantages and one disadvantage of electric braking.
- Draw and explain heating curve for motor.
- Draw symbol and state application of a contactor.
- Which motor you will select for a crane for lifting and lowering operation? Why?
- What do you mean by regenerative braking?

Q.No.2. Answer any two of the following Questions:

2 x 6 = 12

- State and briefly explain any six factors you will consider for selecting a motor for drive application.
- Draw a characteristic and explain four quadrant operation of a motor driving a hoist load.
- Draw motor and load characteristics and explain for:
i) Stable operation ii) Unstable operation

Q.No.3. Answer any two of the following Questions:

2 x 6 = 12

- With a neat connection diagram and characteristics, explain counter current braking of DC shunt motor.
- With a neat diagram explain Kramer control method for induction motor.
- With a neat diagram explain V/F method of speed control for three phase induction motor.

Q.No.4. Answer any two of the following Questions:

2 x 6 = 12

- With neat diagrams explain for motors:
i) Short time duty ii) Intermittent periodic duty
- With a neat diagram explain the need and use of flywheel for load equalization.
- A motor driving some equipment has to deliver a load which follows following load cycle:
i) 37KW for 10 minutes ii) No load for 5 minutes iii) 19KW for 10 minutes iv) No load for 5 minutes
The cycle being repeated indefinitely. Estimate a suitable size of continuously rated motor for above application.

Q.No.5. Answer any two of the following Questions:

2 x 6 = 12

- With the help of power circuit and control circuit explain DOL starter.
- With the help of power circuit and control circuit how reversal of direction of rotation of three phase induction motor can be achieved.
- With the help of power circuit and control circuit explain remote control operation of three phase induction motor.

Q.No.6. Answer any two of the following Questions:

2 x 6 = 12

- a) Write a short note on drive motor for window air conditioner.
- b) With a neat diagram explain dynamic braking of DC shunt motor.
- c) With a neat power and control circuit how motor fed from two sources can be safely operated.

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PORVORIM-GOA
April, 2026 Examinations

Programme: **Common**

Subject: **Industrial Organisation & Management (CC601)**

Time Duration: **3 Hrs.**

Max. Marks: **75**

Instructions: 1) All questions are compulsory.

2) Figures to the right indicate full marks.

3) Assume suitable additional data if required.

Q.No.1. Answer any five of the following Questions:

5 x 3 = 15

- List the advantages of partnership organization.
- Explain the packing and forwarding function in the industry.
- What do you understand by economic order quantity?
- Explain the term arbitration.
- Write down any three points of difference between PERT and CPM.
- Differentiate between incentive and wage.

Q.No.2. Answer any two of the following Questions:

2 x 6 = 12

- Write down the salient features of a public limited company.
- Explain line organization with the help of a sketch.
- Why management is called an art as well as science?

Q.No.3. Answer any two of the following Questions:

2 x 6 = 12

- Explain the following functions of management:
i) Forecasting ii) Controlling
- Write a note on marketing and sales promotion function in the industry.
- Explain ABC analysis in materials management with a neat sketch.

Q.No.4. Answer any two of the following Questions:

2 x 6 = 12

- Explain the elements of cost.
- Explain the importance of break-even chart with a neat sketch.
- A machine was purchased for Rs.91,000. The estimated life of machine is 14 years and scrap value is Rs.20,000. If the rate of interest is charged at 5%, calculate the rate of depreciation by sinking fund method. What will be depreciation amount after 3 years?

Q.No.5. Answer any two of the following Questions:

2 x 6 = 12

- Differentiate between selection and recruitment.
- Write the characteristics of a good incentive plan.
- Write a note on the Workmen Compensation Act 1923.

Q.No.6. Answer any two of the following Questions:

2 x 6 = 12

- Explain in brief grievance handling mechanism.
- i) Write a note on GST.
ii) Define the following terms with respect to network analysis: i) Critical path ii) Most likely time iii) Pessimistic time
- The activity details and their predecessor are given below along with their activity times:

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Activity	Predecessor	Activity time (days)
A	-	11
B	A	09
C	B	08
D	B	10
E	B	07
F	C, D, E	14

Draw network diagram. Determine the critical path and project duration.

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April, 2026 Examinations

Programme: **Electrical Engg.**

Subject: **Electrical Safety Management (EL632)**

Time Duration: **3 Hrs.**

Max. Marks: **75**

Instructions: 1) All questions are compulsory.

2) Figures to the right indicate full marks.

3) Assume suitable additional data if required.

Q.No.1. Answer any five of the following Questions:

5 x 3 = 15

- List the various types of electrical hazards.
- State the causes of fire in electrical installation.
- What are the key methods used in control of bleeding.
- Define: i) Step potential ii) Touch potential
- State the objectives and scope of IE Act and IE rules.
- List any three do's and three don'ts for safety in the use of domestic electrical appliances.

Q.No.2. Answer any two of the following Questions:

2 x 6 = 12

- State and briefly explain six approaches to prevent accidents.
- Explain the adverse effects of AC shocks as compared to DC shocks on human body.
- Explain lightning over voltage surges and list what protective or preventive measures can be implemented to mitigate damage to electrical equipments.

Q.No.3. Answer any two of the following Questions:

2 x 6 = 12

- Write a short note on fire prevention.
- List the principle of actions to be taken after an electric shock.
- Explain Nielson's arm lift back pressure method of artificial respiration.

Q.No.4. Answer any two of the following Questions:

2 x 6 = 12

- What measures are to be taken for the removal of contact with live conductor?
- List any six advantages of neutral grounding.
- What are the functional requirements of earthing system?

Q.No.5. Answer any two of the following Questions:

2 x 6 = 12

- Explain creepage distance. What are the standard creepage distances required for outdoor insulators?
- Explain the significance of safety documentation and the work permit system in ensuring workplace safety.
- Prepare one sample for Limited Work Permit.(LWP)

Q.No.6. Answer any two of the following Questions:

2 x 6 = 12

- What are the key safety aspects to be considered when bringing electrical equipments back into service after maintenance or repair work?
- State and explain IE rule 77 along with its relevant sub rules.
- List some of the important safety requirements in respect of wiring and electrical installation of a domestic home.
- State and explain any six causes that lead to sparking, flashover in electrical installations.

BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

April, 2026 Examinations

Programme: **Electrical Engg.**

Subject: **Energy Management (EL630)**

Time Duration: **3 Hrs.**

Max. Marks: **75**

Instructions: 1) All questions are compulsory.

2) Figures to the right indicate full marks.

3) Assume suitable additional data if required.

Q.No.1. Answer any five of the following Questions:

5 x 3 = 15

- State any three factors that decide the quality of incoming supply?
- List any three instruments used for measuring electrical and non electrical parameters in energy Audit.
- List down the objectives of tariff.
- Define: i) Installed load efficacy ratio ii) Colour rendering index
- List down three advantages of electronic ballast.
- Define: i) Pump capacity ii) Hydraulic Power
- What is a soft starter? List any two advantages of soft starter.

Q.No.2. Answer any two of the following Questions:

2 x 6 = 12

- Briefly describe energy strategy for the future.
- Briefly explain any six features of Energy Conservation Act 2001.
- What is the importance of flattening the load curve? Also explain the various methods by which it can be achieved.

Q.No.3. Answer any two of the following Questions:

2 x 6 = 12

- What is detailed Energy Audit and explain its methodology.
- Classify Energy Audit. Elaborate on preliminary Energy Audit.
- What are the objectives of Energy Audit? List down the benefits of Energy Auditing?

Q.No.4. Answer any two of the following Questions:

2 x 6 = 12

- Briefly explain the components of tariff structure.
- Define power factor. Briefly explain cost benefit if consumer operates his load on higher power factor.
- A 3 ϕ , 5KW induction motor has a power factor of 0.75 lagging. A bank of capacitors is connected in delta across the supply terminals and the power factor is raised to 0.9 lagging. Determine the KVAR rating of the capacitor connected in each phase.

Q.No.5. Answer any two of the following Questions:

2 x 6 = 12

- State the methods used for flow measurement in pumps. Explain any two methods.
- Explain the various methods for determining motor loading.
- Outline step by step procedure for lighting performance assessment.

Q.No.6. Answer any two of the following Questions:

2 x 6 = 12

- Write a short note on automatic power factor controller.
- List the various Watt loss areas in motors. Also suggest modifications to be implemented for improving the efficiency of motors.
- Explain with reference to energy efficient lighting control:
i) Localized switching ii) Daylight linked control iii) Time based control

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April, 2026 Examinations

Programme: **Electrical Engg./E&EE**

Subject: **Substation Practices (EL622)**

Time Duration: **3 Hrs.**

Max. Marks: **75**

Instructions: 1) All questions are compulsory.

2) Figures to the right indicate full marks.

3) Assume suitable additional data if required.

Q.No.1. Answer any five of the following Questions:

5 x 3 = 15

- Draw symbol and state functions of:
i) Circuit breaker ii) Isolators
- State different colour lamps used in control panel. What each colour will indicate?
- What is earth switch? State its importance in substation.
- With a neat diagram briefly explain importance of mimic diagram.
- What is the sequence of operation while opening and closing of isolators, circuit breaker and earthing switches?
- Explain trickle charging of batteries.
- What are permissible values of earthing resistance for large, major and small substations?
- List down the desirable characteristics of tariff.
- Give the general specifications for procurement of PT.

Q.No.2. Answer any two of the following Questions:

2 x 6 = 12

- Draw a neat single line diagram of 33KV/11KV substation and give function of each component at the substation.
- Distinguish between indoor and outdoor substation. Which type is normally preferred and why?
- Write a short note on relay and control panel for substation.

Q.No.3. Answer any two of the following Questions:

2 x 6 = 12

- What are surge absorbers? Explain different types of surge absorbers.
- State and explain factors that determine the current carrying capacity of underground cables.
- With a neat diagram explain double bus bar with 2 breaker arrangement.

Q.No.4. Answer any two of the following Questions:

2 x 6 = 12

- Explain the concept of step and touch potential and list down the various methods to reduce them.
- List the different methods of neutral earthing. Explain any one in detail with its merits and demerits.
- Explain maximum demand tariff. State its merits and demerits.
- List the various methods of laying underground cables. Briefly explain each of them.

Q.No.5. Answer any two of the following Questions:

2 x 6 = 12

- What are the various methods used for power factor improvement? Explain briefly each of them.
- List down the disadvantages of low power factors and its causes.
- Briefly explain maximum demand tariff and power factor tariff.
- Give the difference between CT for measurement and CT for protection? Explain ratio error and phase angle error.

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Q.No.6. Answer any two of the following Questions:

2 x 6 = 12

- a) List and explain the maintenance tests carried out on insulation oil of a transformer.
- b) What is the importance of work permit? What are the safety precautions to be taken while carrying out works in a substation?
- c) i)What is a hydrometer? What is it used for?
ii)What measures need to be taken to improve the quality of transformer oil?
- d) With a neat diagram explain clamp on ammeter.
