BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

November, 2025 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**

a) Find length of the Arc of a circle of radius 10cm and angle at the centre is 60^0.
b) Find equation of line having slope 3 and passing through point (2,3)
c) State nature of roots and Solve $3x^2-4x+2=0$
d) Divide x^3-5x^2+4x+1 by $(x+2)$
e) Find volume of frustum of cone having end radii as 4cm and 2cm and height of frustum is 3cm.
f) Find slope of tangent to curve $y=x^2+3x$ at (1,4)
g) Find $\frac{dy}{dx}$ if $y= 3x\tan x$
h) Find centre and radius of circle $x^2+y^2=16$

Q.No.2. Answer any three of the following Questions: **3 x 4 = 12**

a) Find equation of circle having (2,4) and (-1,3) as end points of the diameter.
b) Find equation of line passing through points (3,4) and (2,5)
c) Find value of p if line $px+3y+1=0$ is perpendicular to line $3x-y+5=0$
d) Find equation of line passing through (2,3) and perpendicular to line $y=4x+2$
e) Find equation of circle concentric to circle $x^2+y^2-4x-2y+1=0$ and having radius 5 units.

Q.No.3. Answer any three of the following Questions: **3 x 4 = 12**

a) Prove $\frac{\tan x+\sin x}{\tan x-\sin x}=\frac{1+\cos x}{1-\cos x}$
b) In any ΔABC show $\frac{a}{bc}+\frac{\cos A}{a}=\frac{a^2+b^2+c^2}{2abc}$
c) Solve ΔABC if $\angle A=102^0$, $\angle B=26^0$ and b=61cm
d) Find $\tan\theta$ and $\cot\theta$ if $\sin\theta=\frac{4}{5}$ and θ lies in I quadrant.
e) In ΔABC if a = 3cm, b= 4 cm, c=5cm, find cos A and cos B

Q.No.4. Answer any three of the following Questions: **3 x 4 = 12**

a) Evaluate $\lim_{x\to 0}\frac{(4^x-1)\sin(5x)}{x^2}$
b) Evaluate $\lim_{x\to 0}\frac{(1+6x)^{1/x}\tan(2x)}{x}$
c) Find maximum and minimum for the function $y=x^3-9x^2+24x$
d) If displacement S of a particle at time 't' it is given by $S=2t^3-9t^2+12t$, find time when body stops.
e) Evaluate $\lim_{x\to 3}\left[\frac{1}{x-3}-\frac{3}{x^2-3x}\right]$

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Q.No.5. Answer any three of the following Questions: **3 x 4 = 12**

a) Find $\frac{dy}{dx}$ if: i) $y=\frac{e^{4x}}{5x+1}$ ii) $y=5^x+2\sec x+\log(2x)$

b) Find $\frac{dy}{dx}$ if $xy = x^2+y^2$

c) Find $\frac{dy}{dx}$ if $y = (\tan)^x$

d) Find $\frac{dy}{dx}$ if $\log y=x^3e^{2x}$

e) Find $\frac{dy}{dx}$ if $x=1+\cos(2t)$, $y=1-\sin(3t)$

Q.No.6. Answer any three of the following Questions: **3 x 4 = 12**

a) Find x if: i) $\log_x 36=2$ ii) $\log(2x+1)+\log 3 = 3\log 2$

b) Find volume and lateral surface of pyramid whose base is hexagon of side 10cm. Given height of pyramid of 25cm and slant height is 26.46cm.

c) Find area by Simpson Rule from the given data.:

x(cm)	2	5	8	11	14	17	20	23
d (cm)	2.8	3.5	3.7	4.2	4.5	3.8	2.1	1.9

d) Find height of a prism having base as equilateral triangle of side 4cm and volume of the prism is $16cm^3$

e) Find $\frac{dy}{dx}$ if $y=\frac{(2x+1)^3\sin(4x)}{e^{5x}}$

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BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

November, 2025 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) State the relation between linear expansion (α) and cubical expression (γ) (1)

b) What is positive zero error in the case of micrometer screw gauge? (2)

c) Define least count of a Vernier Calliper. State its formula. (2)

d) Define one Newton. (2)

e) Distinguish between vectors and scalars. (any two points) (2)

f) Why curved roads are banked? (2)

g) Define radial acceleration and write down its expression. (2)

h) What is meant by critical velocity of a liquid? (2)

i) State Boyle's Law. (2)

j) Define angle of contact. (2)

k) Define: i) Variable state ii) Steady state (2)

Q.No.2. Answer any three of the following Questions: **3 x 4 = 12**

a) State the fundamental quantities, their units and symbols in S.I. units.

b) Check the correctness of the following equation using dimension:
i)P= mgh, where P=Potential energy, m=mass, g=acceleration due to gravity, h=height
ii)$T=2\Pi\sqrt{\frac{l}{g}}$ where T=period, l=length and g=acceleration due to gravity

c) Convert the following values from one system to another:
i)30 Ns/m^2 to C.G.S. system ii)80$gm.cm^2/s^2$ to S.I system

d) Obtain the dimension Young's Modulus.

e) State any four types of errors. Explain any one of them.

Q.No.3. Answer any three of the following Questions: **3 x 4 = 12**

a) Classify the following into scalars and vectors:
i)Acceleration ii) Volume iii) Temperature iv) Energy
v) Pressure vi) Voltage vii) Electric intensity vii) Magnetic flux

b) State law of conservation of energy. Give one example of kinetic energy and potential energy.

c) Define and write down the S.I. units of: i)Force ii) Work

d) A locomotive pulls a train with uniform velocity 100km/hr. Find the work done by the locomotive in 10 minutes, if the force exerted is 20KN.

e) A body is thrown vertically upwards from the ground with an initial velocity 45m/s. Find the maximum height reached by the body and the time taken to reach it.

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Q.No.4. Answer any three of the following Questions: **3 x 4 = 12**

a) Define acceleration due to gravity. Obtain an expression for it.

b) Show that $\tan\theta=\frac{v^2}{rg}$, where θ=angle of banking, v=velocity of the vehicle, r=radius of curvature of the road

c) Define centrifugal force, sate its expression and give two applications.

d) A body of mass 0.06kg is tied to a string and is whirled in a horizontal circle of radius 0.7m, making 80r.p.m. Find the tension along the string.

e) What is escape velocity? State the expression for it. Calculate escape velocity on the surface of the earth. Given radius of earth=6.4×10^{6}m, mass of earth=6×10^{24} kg, G=6.67×10^{-11} Nm^2/kg^2

Q.No.5. Answer any three of the following Questions: **3 x 4 = 12**

a) Define shearing strain. Draw the diagram. Show that shearing strain is equal to shear angle.

b) State four applications of surface tension.

c) With a neat diagram, explain terminal velocity of a spherical body falling through viscous liquid.

d) A force of 8N required to move a liquid over a solid surface of area $0.3m^2$ with velocity of 0.055m/s. If the thickness of the liquid layer is 0.003m, calculate coefficient of viscosity.

e) A force of 100N is applied at the lower end of a wire of length 4.5m, cross-sectional area is $0.25m^2$. Find the elongation of the wire. Y for wire is 2×10^{11} N/m^2

Q.No.6. Answer any three of the following Questions: **3 x 4 = 12**

a) Distinguish between conduction, convection and radiation. (three points)

b) State law of thermal conductivity. Draw diagram and state its equation.

c) Define the following terms: i)Specific heat ii)Latent heat of vapourisation

d) Certain mass gas occupies 45CC at 40°C and 680mm pressure. What volume will the gas occupy at 60°C and 980mm pressure?

e) A glass window pane 1.5m long and 0.75m broad is 2mm thick. Calculate the thermal conductivity of glass if 2.5Kcal of heat is conducted per second and the temperature difference between both sides is 12°C

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BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

November, 2025 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: **5x3=15**

a) State Aufbau Principle. Write the values of principal quantum number (n) and Azimuthal quantum number(l) for 3p,4f,6d and 2S orbital.

b) For principal quantum number 'n' = 4, write the possible values of Azimuthal quantum number (l) and magnetic quantum number(ml)

c) What are the causes of hardness in water?

d) Define the following terms: i)Electrolyte ii) Electrolysis iii)Degree of Ionization

e) Write a note on corrosion due to gases.

f) Give reasons for following: i)Part of nail inside wood corrodes ii)Why galvanized wares are not used for storing food stuff?

g) State any three drawbacks of natural rubber.

h) i)Which of the following metals can displace H_2 gas from acid solutions and why? Zn, Cu, Ag, Au?
ii)Give two points of difference between temporary and permanent hardness of water.

Q.No.2. Answer any three of the following Questions: **3 x 4 = 12**

a) How covalent bond is formed? Explain the information of O_2 molecule by covalency.

b) Give four points of difference between orbit and orbital.

c) Define Quantum Numbers. Explain the significance of principal and Spin quantum numbers.

d) State Octet rule. Write the orbital electronic configuration of Neon, Magnesium and Chlorine.

Q.No.3. Answer any three of the following Questions: **3 x 4 = 12**

a) What is desalination of brackish water? With the help of diagram, explain the process of electro-dialysis for desalination of brackish water.

b) i) Define sludge and scale.
ii)What are the disadvantages of sludge and scale formation in boilers?

c) Define hard water. Explain the disadvantages of using hard water for domestic purpose.

d) With reference to zeolite process of water softening:
i)Write the formula of sodium zeolite.
ii)Write one reaction each for removal of temporary and permanent hardness of water.
iii)Write the reaction for regeneration of exhausted zeolite.

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Q.No.4. Answer any three of the following Questions: **3 x 4 = 12**

a) State any four postulates of Arrhenius theory of electrolytic dissociation.

b) In the electrolysis of aqueous $CuSO_4$ solution using platinum electrodes:
i)Write the ionization reactions.
ii)Write the reactions occurring at cathode and anode.
iii)Why the intensity of blue color of solution decreases?

c) Explain the process of electrolysis of aqueous NaCl solution using platinum electrodes.

d) Define corrosion. Describe the different types of oxide layers formed in oxidation corrosion.

Q.No.5. Answer any three of the following Questions: **3 x 4 = 12**

a) With a neat diagram, explain the oxygen absorption mechanism of electrochemical corrosion.

b) State any four principles of corrosion control by proper designing of metallic structures.

c) Explain the following methods of environment modification to control corrosion: i)Dehumidification ii)Deactivation

d) Describe the process of galvanizing for protection of metals from corrosion.

Q.No.6. Answer any three of the following Questions: **3 x 4 = 12**

a) Describe the process of metal spraying.

b) Define Addition Polymerization. Write equation for polymerization of: i)Ethene to polyethene ii)Vinyl Chloride to Polyvinyl Chloride

c) What is vulcanization of rubber? Give the reaction for vulcanization of rubber and state why it is necessary to vulcanize natural rubber.

d) Define Galvanic Corrosion. Explain galvanic corrosion giving any two examples.

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BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

November, 2025 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 'x' if $\begin{vmatrix} x & 5 \\ -2 & 1 \end{vmatrix} = \begin{vmatrix} 4 & 2 \\ -1 & 3 \end{vmatrix}$

b) Find a, b, c, d, if $\begin{bmatrix} a-5 & b+2 \\ 2c & d-1 \end{bmatrix} = 2\begin{bmatrix} -1 & 2 \\ 1 & 4 \end{bmatrix}$

c) Find unit vector along $\overline{AB}$, if the position vectors are $\overline{OA} = \hat{i}+2\hat{j}+\hat{k}$ and $\overline{OB} = 3\hat{i}+\hat{j}-2\hat{k}$

d) Find $\bar{a}.(\bar{b}+\bar{c})$ if $\bar{a} = 2\hat{i}+2\hat{j}+\hat{k}$, $\bar{b} = \hat{i}-\hat{j}+4\hat{k}$ and $\bar{c} = 3\hat{i}+2\hat{j}+2\hat{k}$

e) Find $\int (x^2+1)^2 dx$

f) Evaluate $\int_0^{\log 2} e^{2x} dx$

Only for Mechanical Engg & allied branches:

g) Find mean, median and mode of the numbers 5, 3, 7, 5, 6, 4.

h) Find arithmetic mean of the frequency distribution:

Classmarks	2	4	6	8	10
Frequencies	1	3	7	6	3

Only for Electronics Engg & allied branches:

g) Find 'a' and 'b' if 2a+ib = 3+4i+7+i

h) Find $|2z_1 + z_2|$, if z_1=2+3i and z_2=8-i

Q.No.2. Answer any three of the following Questions: **3 x 4 = 12**

a) Solve by using Cramer's rule:
2x+y-z=6
3x+2y+z=7
4x-3y+2z=3

b) If the matrix $A = \begin{bmatrix} 2 & 1 & 3 \\ 1 & 2 & 1 \\ 4 & 0 & 5 \end{bmatrix}$, find A^{-1}

c) Solve using matrix method:
6x-y=2
5x+y=9

d) If $A=\begin{bmatrix}1 & 2\\ 4 & 3\end{bmatrix}$, show that $A^2-4A-5I=0$

e) If $A=\begin{bmatrix}1 & 2 & 3\\ -1 & 2 & 0\end{bmatrix}$ and $B=\begin{bmatrix}2 & 1\\ 1 & -1\\ 4 & 2\end{bmatrix}$; find AB and BA

3 x 4 = 12

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

a) Show that the vectors $\bar{a}=4\hat{i}+3\hat{j}+4\hat{k}$, $\bar{b}=\hat{i}+3\hat{j}-2\hat{k}$ and $\bar{c}=\hat{i}+3\hat{j}+5\hat{k}$ from sides of a right angled triangle.

b) Find angle between $\overline{AB}$ and $\overline{AC}$ with vertices A(1,1,2) B(4, 5, 3) C(3,2,4)

c) If $\bar{a}=2\hat{i}+2\hat{j}-\hat{k}, \bar{b}=\hat{i}+2\hat{j}+\hat{k}$; find: i) Vector perpendicular to $\bar{a}$ and $\bar{b}$ ii) Projection of $\bar{b}$ on $\bar{a}$

d) Find the value of 'p' if $\bar{a}=p\hat{i}+2\hat{j}-6\hat{k}$, $\bar{b}=4\hat{i}+\hat{j}-3\hat{k}$, $\bar{c}=\hat{i}+\hat{j}+2\hat{k}$ are co-planar.

e) Find the area of ΔABC, if the position vectors of A, B, C are $\overline{OA}=-\hat{i}+2\hat{j}-\hat{k}$, $\overline{OB}=2\hat{i}+\hat{j}+3\hat{k}$ and $\overline{OC}=\hat{i}+3\hat{j}+3\hat{k}$

3 x 4 = 12

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

a) Find $\int\left(\cos 4x+e^{2x}+4^x+\frac{1}{5x+3}\right)dx$

b) Find $\int x\sin 6x$

c) Find $\int\frac{1}{x^2+8x+12}dx$

d) Find $\int\frac{1}{\sqrt{3x+2}-\sqrt{3x-1}}dx$

e) Find $\int\tan^5 x\sec^2 x\,dx$

3 x 4 = 12

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

a) Find $\int\frac{2x+7}{x^2+7x+9}dx$

b) Evaluate $\int_0^6\frac{\sqrt{x}}{\sqrt{x}+\sqrt{6-x}}dx$

c) Find area enclosed by $y=4x-3$ and the lines $x=1$ and $x=2$ and X-axis.

d) Find the volume generated by rotating area above X-axis, enclosed by $y^2=4x$, $x=0$ and $x=1$

e) Evaluate $\int_{-1}^{1}\frac{1}{x^2+2x+5}dx$

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Only for Mechanical Engg. & allied branches: 3 x 4 = 12

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

a) Find the median value for the given data:

Class interval	0-20	20-40	40-60	60-80	80-100
Frequency	10	12	13	8	5

b) Find the mode value for the following data:

Class interval	1-1.9	2-2.9	3-3.9	4-4.9	5-5.9
Frequency	8	17	20	13	12

c) Find the mean deviation from the given distribution:

Class interval	0-4	4-8	8-12	12-16
Frequency	2	6	7	5

d) Find standard deviation from the data given below:

Class mark (xi)	5	10	15	20	25
Frequency (fi)	12	16	24	11	7

e) Find mean deviation and standard deviation of the numbers 3, 5, 7, 4, 1

Only for Electronic Engg. and allied branches: 3 x 4 = 12

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

a) Express in Polar form: i) $z_1 = \sqrt{3} + i$ ii) $z_2 = -1 - i$

b) If z_1=3-2i, z_2=4+3i and z_3=2+i; find: $(z_1 - z_2)\ (z_2 - z_3)$

c) Find 'a' and 'b' if: $a + ib = \dfrac{(1+2i)(2-3i)}{4-i}$

d) Express in the form a+ib, $\dfrac{i^{17} - 3i^{15} + i^8}{2 + i^6 - i^3}$

e) Simplify using De Moivre's theorem:

$$\frac{(\cos 2\theta - i\sin 2\theta)^2 \left(\cos\frac{\theta}{3} + i\sin\frac{\theta}{3}\right)^9}{(\cos 5\theta + i\sin 5\theta)^{3/5} \left(\cos\frac{3\theta}{4} - i\sin\frac{3\theta}{4}\right)^8}$$

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BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

November, 2025 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):

a) State SI unit of electric potential. (01)
b) Define electric field. (02)
c) Define capacitance. (02)
d) State law of resistances in series. (02)
e) A potential difference of 100V is applied across a resistance of 20 ohm. Determine the current flowing through resistance. (02)
f) Convert 1KWh into joules. (02)
g) State right hand thumb rule. (02)
h) Define self induction. (02)
i) Define refraction. (02)
j) Give the name of any two sources of LASER. (02)
k) State two applications of resonance. (02)

Q.No.2. Answer any three of the following Questions: **3 x 4 = 12**

a) State four important properties of electric lines of force.
b) Two charges of 30 micro Coulomb and 50 micro Coulomb are placed 0.2m apart in air. Calculate force between them.
c) Find the electric intensity at a point 0.6m from a charge of 40 micro coulomb placed in medium of dielectric constant 2.5.
d) Two capacitors of 12F and 24F are connected in: i) Series ii) Parallel. Find effective capacitance in each case.
e) Draw a circuit diagram with three resistances connected in parallel across a battery of V Volt. Write the equation for effective resistance.

Q.No.3. Answer any three of the following Questions: **3 x 4 = 12**

a) Define: i) Specific resistance ii) Electric power
b) Draw Wheatstone's network and write balancing condition.
c) The copper wire has a resistance of 4 Ohm at 0°C. Determine its resistance at 60°C. Temperature coefficient of copper = 0.00426/°C
d) State Joule's law of electrical heating. Write an expression.
e) A person uses, 4 number of 60W bulbs and 2 number of 100W fans, on an average 8 hours a day. Calculate energy bill for the month of 30 days at Rs. 3 per unit.

Q.No.4. Answer any three of the following Questions: **3 x 4 = 12**

a) Explain magnetic effect of electric current as demonstrated by Oersted's experiment. Write the conclusion.
b) Explain the principle of transformer. Draw parts of transformer.
c) i) Define Magnetic flux. ii) State Lenz's Law.
d) A wire carrying current of 6A is 0.5m long. What will be the force acting on it, if it is kept in a magnetic field of strength 4.5×10^{-3} T at an angle of 60° to the direction of the field?
e) Explain mutual induction with neat diagram.

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Q.No.5. Answer any three of the following Questions: **3 x 4 = 12**

a) Explain total internal reflection with ray diagram.

b) What are X rays? State three important properties of x-rays.

c) A ray of light is travelling from air to glass. The angle of incidence is 30° and refractive index of glass is 1.5. Determine angle of refraction.

d) i) State two properties of LASER. ii)State two applications of LASER.

e) Two lamps of 10 Candela and 90 Candela are placed 1.5m apart. Find the position of the point between them, where luminance due to two sources will be equal.

Q.No.6. Answer any three of the following Questions: **3 x 4 = 12**

a) i) Define amplitude and frequency of sound wave.
ii)Write the relation between wavelength, frequency and velocity of a wave.

b) Explain free and forced vibration with an example for each.

c) Define pitch of a sound. Draw waveform to represent high pitch and low pitch sound.

d) Explain how ultrasonic waves are used to find the depth of the sea with diagram.

e) When a resistance of 12 Ohm is connected in the left gap of meter bridge, the null point is situated at 40cm. Find the value of resistance in the right gap.

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BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

November, 2025 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**

a) What is Ecological Footprint?
b) Name any six Biogeographical zones of India.
c) What is land degradation? List the methods of control of land degradation.
d) How is high activity radioactive waste disposed?
e) What are secondary air pollutants? Give example.
f) Explain the role of decomposers in an ecosystem.
g) State any six rules you will follows as not to violate Motor Vehicle Act.

Q.No.2. Answer any two of the following Questions: **2 x 6 = 12**

a) Write a note on Environment Impact Assessment.
b) Discuss the environmental ethics to be developed as true earth citizen.
c) State any six Human Rights.

Q.No.3. Answer any two of the following Questions: **2 x 6 = 12**

a) Explain primary ecological succession.
b) Write a note on In-Situ or Ex-Situ method of conservation of biodiversity.
c) Describe: i) Desert Ecosystem ii) Ocean Ecosystem

Q.No.4. Answer any two of the following Questions: **2 x 6 = 12**

a) Discuss the effect of excessive use of synthetic pesticides in modern agriculture on environment.
b) Discuss any six drawbacks of construction of dams.
c) What are the causes of deforestation? Explains the steps taken for forest management.

Q.No.5. Answer any two of the following Questions: **2 x 6 = 12**

a) What is Green House effect and Global Warming? Explain its effects.
b) Discuss how pathogens and heavy metals in polluted water affect human health.
c) Explain the method of composting of wet waste and methods of waste utilization with examples.

Q.No.6. Answer any two of the following Questions: **2 x 6 = 12**

a) Discuss the effects of noise pollution on human health. What precautions will you take to protect yourself from noise pollution?
b) Discuss the short term and long term effects of marine water pollution due to oil spills.
c) Explain the role of Information Technology in environment.

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BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

November, 2025 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**

a) Differentiate between Metals and Non-Metals.
b) List down the properties and uses of high speed steel.
c) Write a note on semiconductor materials.
d) Explain the composition and properties of Bricks.
e) Classify magnetic materials giving two examples of each type.
f) Write a note on lead and its hazards to environment.

Q.No.2. Answer any two of the following Questions: **2 x 6 = 12**

a) State and define any three mechanical properties and any three physical properties of engineering materials.
b) Explain any two types of cast iron along with its properties and applications.
c) List down various constituents of aluminium alloys. Explain effect of these constituents on properties of metal.

Q.No.3. Answer any two of the following Questions: **2 x 6 = 12**

a) Write a short note on properties and uses of stainless steel.
b) State various desirable properties of refractory materials.
c) List down common varieties of timber. Also state any four uses of timber.

Q.No.4. Answer any two of the following Questions: **2 x 6 = 12**

a) Write a note on classification of rocks.
b) What are insulting materials? State the characteristics and application of any two solid insulating materials.
c) What are high conductivity materials? State properties and applications of any two high conductivity materials.

Q.No.5. Answer any two of the following Questions: **2 x 6 = 12**

a) Give specification of Silicon and Germanium as semiconductor material along with their uses.
b) What are different constituents of paints? Explain any three constituents in detail.
c) Write a note on function of lubricants.

Q.No.6. Write short note any three: **3 x 4 = 12**

a) Magnetic properties of engineering materials
b) Types of reinforcement materials and their applications
c) Properties and uses to soda glass
d) Classification materials as conductor, semiconductor and insulating materials

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BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

November,2025Examinations

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**

a) Draw a power triangle and explain different power.
b) Define positive, negative and zero sequence component.
c) Give the relationship between:i) Line voltage and phase voltage ii) Line current and phase current, in a star connected 3 phase network.
d) Define:i) Non linear circuit ii) Unilateral circuit iii) Passive network
e) Define i) Bandwidth ii) Q factor
f) State and explain Kirchoff's voltage law or Mesh law.
g) A capacitor and resistor are connected in series to an ac supply of 50V, 50Hz. The current is 2A and power dissipated is 80W. Calculate the resistance and capacitance of the capacitor.

Q.No.2. Answer any two of the following Questions: **2 x 6 = 12**

a) Find out the equivalent resistance between terminals B and C of the circuit shown in fig.1.
b) In the fig.2. frame and solve the node equations of the network. Hence find the total power consumed by the passive elements of the network.
c) Apply Thevenin's theorem to find current flowing through the 12Ω resistor in the circuit of fig.3.

Q.No.3. Answer any two of the following Questions: **2 x 6 = 12**

a) A coil having a resistance of 15 Ohm and an inductance of 0.2H is connected in series with another coil having a resistance of 25Ω and an inductance of 0.04H to a 230V, 50Hz supply. Determine:i) Voltage across each coil ii) Power dissipated in each coil iii) Power factor of the circuit as a whole
b) Two circuits the impedance of which are given by $Z_1=10+j15$ and $Z_2=6+j8$ Ohm are connected in parallel. If the total current supplied is 15A, what is the power taken by each branch?
c) In a series circuit containing pure resistance and pure inductance, the voltage and current are expressed as:
$v(t) = 15\sin(314t+\frac{5\pi}{6})$ $i(t)=5\sin(314t+\frac{2\pi}{3})$
i) What is the impedance of the circuit?
ii)What is the value of the resistance?
iii)What is the inductance in Henries?
iv)What is the average power drawn by the circuit?
v)What is the power factor?

Q.No.4. Answer any two of the following Questions: **2 x 6 = 12**

a) Draw the graphical representation for variation of resistance, inductive reactance, capacitive reactance, impedance, current with frequency, for a series RLC circuit and explain it.

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b) A series circuit with resistance of 100 Ohm, inductance of 0.2H and capacitance of 40μF is given a 100V supply at variable frequency. Find:i) Resonance frequency ii) Current in the circuit at resonance iii) Power consumed in the circuit at resonance iv) Q factor v) Bandwidth

c) Derive an expression for the resonant frequency of the parallel circuit.

2 x 6 = 12

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

a) A three phase load consists of three inductive coils, each of resistance 50Ω and inductance of 0.3H. The supply is 415V, 50Hz. The load is connected in star. Calculate: i) The line current ii) The power factor iii) The total active power and the total apparent power

b) Three identical impedances are connected in delta to a 3 phase 400V, 50Hz supply. The line current is 35A and the total power taken from the supply is 14.5KW. Calculate the resistance and inductance of each impedance.

c) Derive the relationship between line and phase quantities in a delta connected system.

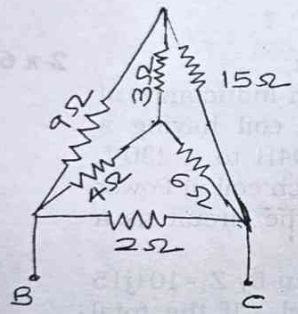
2 x 6 = 12

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

a) Find out the positive, negative and zero phase sequence components of the following set of three unbalanced voltage vectors:
$V_A=10\angle 30^\circ$ $V_B=30\angle -60^\circ$ and $V_C=15\angle 45^\circ$

b) The following currents were recorded in the RYB lines of a 3 phase system under abnormal condition:
$I_R=300\angle 300^\circ A$, $I_Y=500\angle 240^\circ A$ and $I_B=1000\angle 60^\circ A$
Calculate the values of positive, negative and zero phase sequence components.

c) In the fig.4.threeimpendences, $Z_1=(2+j3)$Ohm, $Z_2=5-j8\Omega$ and $Z_3=6+j0\Omega$ are connected in series. Calculate: i) Current ii) Voltage drops V_1, V_2 and V_3 iii) Power absorbed by each impendence and total power absorbed by the circuit



Fig(1) Q.2(a)

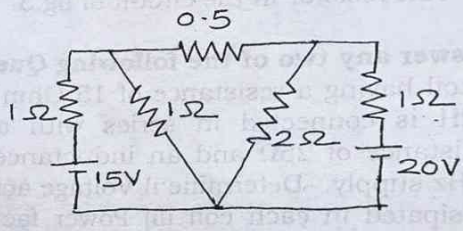


Fig 2 Q.2(b)

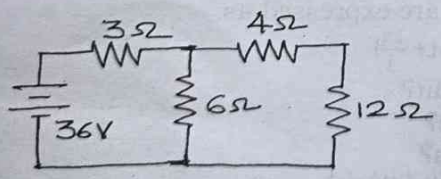


Fig 3 Q.2(c)

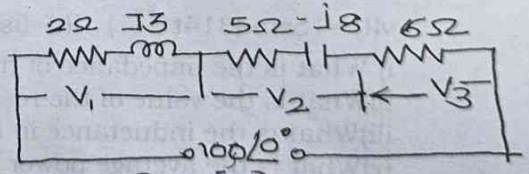


Fig 4 Q.6(c)

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BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

November, 2025 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**

a) State three points of comparison between lap winding and wave winding.
b) Explain the significance of back emf in DC motors.
c) State any three points of comparison between core type and shell type of transformer.
d) Draw a neat labelled phasor diagram of transformer on inductive load.
e) Explain the significance of voltage regulation of transformer.
f) List the necessary conditions for the successful parallel operation of the transformer.

Q.No.2. Answer any two of the following Questions: **2 x 6 = 12**

a) State the functions of following parts of DC machine. Name the material used for each parts:
i)Commutator ii) Brushes iii) Field winding iv) Armature
b) i) List the causes of failure of DC generator to build up voltage.
ii) Write the expression for generated emf in DC generator. State the factors on which generated emf depends.
c) List and explain losses occurring in the DC generator.

Q.No.3. Answer any two of the following Questions: **2 x 6 = 12**

a) Write the speed equation for DC motor. With a neat diagram explain any two methods of speed control of DC shunt motor.
b) State any two features of following DC motors:
i)DC series motor ii) DC shunt motor iii)DC cumulative compound motor
List any three applications of each of the above DC motors.
c) Explain in detail the necessity of starters for starting DC motors. State the advantages of four point starter over three point starter.

Q.No.4. Answer any two of the following Questions: **2 x 6 = 12**

a) Explain the concept of leakage flux in the transformer. What is its significance? List any three methods to reduce leakage flux in the transformer.
b) A 500KVA, 11000V/400V, 50Hz single phase transformer has 100 turns on the secondary winding. Calculate:
i)Approximate number of turns in primary winding
ii)Approximate value of the primary and secondary current
iii)The maximum value of flux in the core
c) Draw a neat labeled equivalent circuit diagram of transformer referred to primary side and explain the same.

Q.No.5. Answer any two of the following Questions: **2 x 6 = 12**

a) A 200KVA, single phase transformer is in circuit continuously. For 8 hours in a day the load is 160KW at 0.8 power factor, for 6 hours the load is 80KW at unity power factor and for remaining period of 24 hours it runs on No

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load. Full load copper losses are 3.02KW and iron losses are 1.6KW. Find all day efficiency.

b) A 10KVA single phase transformer rated for 2000/400V has resistance and leakage reactance as follows:
Primary winding R_1=5.5Ω, X_1 =12Ω
Secondary winding R_2 = 0.2Ω, X_2 = 0.45Ω
Determine the approximate value of secondary voltage at full load 0.8 power factor lagging when the primary voltage is 2000V and also calculate the voltage regulation at this load.

c) With a neat diagram explain in detail open circuit test on transformer and its relevant calculation.

2 x 6 = 12

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

a) List any six advantages of autotransformer over two winding transformer.

b) Write short note on welding transformer.

c) State the functions of following parts of transformer:
i)Conservator ii) Bushings iii) Core iv) Explosion vent

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BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

November, 2025 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**

a) Define the term: i) Resolution ii)Static error
b) How damping torque is produced in PMMC instruments? Briefly explain.
c) How many coils are there in wattmeter? How are they connected?
d) State classification of resistances. Mention range.
e) Why PMMC meter cannot be used for ac measurement?
f) What do you mean by loading effect of voltmeter? Briefly explain.
g) What is phase sequence? Why it is necessary to measure phase sequence?

Q.No.2. Answer any two of the following Questions: **2 x 6 = 12**

a) Briefly explain methods of producing controlling torque in an indicating instrument.
b) Draw respective diagrams and compare air friction damping with eddy current damping.
c) Explain different types of errors. How they can be minimized?

Q.No.3. Answer any two of the following Questions: **2 x 6 = 12**

a) With neat diagram explain construction and working of attraction type moving iron instrument.
b) With the help of diagram and waveform explain full wave type rectifier instrument.
c) Briefly explain different types of errors which can occur in PMMC instruments.

Q.No.4. Answer any two of the following Questions: **2 x 6 = 12**

a) With neat diagram explain principle of operation and construction of dynamometer type wattmeter.
b) With a neat diagram explain how range of single phase energy meter can be extended using CT. Why we do not prefer using PT here?
c) While performing a load test on three phase induction motor by two wattmeter method the reading obtained are 14.2KW and 6.1KW. The readings of second wattmeter was obtained after reversing connection of its current coil. The voltage is 440V. Compute:
i)True three phase power drawn by the motor ii)Power factor iii)Line current

Q.No.5. Answer any two of the following Questions: **2 x 6 = 12**

a) Briefly explain what will be variation in wattmeter readings with variation in load power factor in measurement of three phase power by two wattmeter method.
b) With a neat diagram explain how resistance can be measured using Wheatstone's bridge.
c) With neat diagram explain working of shunt type ohmmeter.

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Q.No.6. Answer any two of the following Questions: **2 x 6 = 1**

a) With neat diagram explain construction and operation of vibrating reed type frequency meter.

b) With neat diagram explain construction and working of earth tester.

c) With neat diagram explain construction and working of power factor meter.

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BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

November, 2025 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**

a) State advantages and disadvantages of wind power generation.
b) What is a solar cell? How it generates electricity?
c) Define: i)Plant use factor ii)Diversity factor
d) State features of RCC poles.
e) List any six components of transmission lines.
f) Briefly explain why transmission lines will have inductance and capacitance.
g) What do you mean by stringing of conductors?

Q.No.2. Answer any two of the following Questions: **2 x 6 = 12**

a) Draw a layout of hydro-electric power station. List the main components and state their function.
b) List main components of diesel generator set. State their functions. State advantages and disadvantages of diesel power generation.
c) Draw schematic diagram of solar thermal power generation. List main components and state their functions.

Q.No.3. Answer any two of the following Questions: **2 x 6 = 12**

a) Briefly explain how the number and rating of generator units are selected for a given load curve.
b) Explain merits and demerits of grid system.
c) A generating station has daily load cycle as given below. Draw the load curve and find maximum demand, load factor and units generated during a day.

Time in hours	0-6	6-10	10-12	12-16	16-20	20-24
Load in MW	40	50	60	50	70	40

Q.No.4. Answer any two of the following Questions: **2 x 6 = 12**

a) Compare EHV-AC transmission with HVDC transmission.
b) What is string efficiency? How it is necessary to have high string efficiency? How can it be achieved?
c) What is corona? How it can be reduced? State its advantages and disadvantages.

Q.No.5. Answer any two of the following Questions: **2 x 6 = 12**

a) Explain the effects of load power factor on the performance of short transmission lines.
b) A three phase, 3 wire system has its conductors arranged at the corners of equilateral triangle of 2m side. The diameter of each conductor is 2.5cm. Calculate inductance and capacitance per Km at the line.
c) A single phase line is transmitting 1100KW power to a factory at 11KV and at 0.8 pf lagging. It has total resistance of 2 Ohms and 100p inductance of 3 Ohms. Determine:
i) % regulation ii)Transmission line efficiency

100p

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Q.No.6. Answer any two of the following Questions: **2 x 6 = 12**

a) Compare renewable energy sources with non renewable energy sources.

b) State properties of: i)ACSR conductor ii)AAC conductor iii)Bundled conductor

c) Why conductors vibrate? What is the effect of the vibrations on conductors? Explain how they can be reduced.

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BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

November, 2025 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**

a) Define analog signal and digital signal.
b) What do you mean by BCD code? Give example.
c) Draw symbol and truth table of EX-OR gate and NOR gate.
d) Draw a block diagram of 4 bit parallel Adder.
e) What is the significance of preset and clear I/PS of flip flop?
f) What are the types of shift registers?
g) Define ADC and DAC. List few applications of each.
h) Draw symbol and truth table of T flip flop.

Q.No.2. Answer any two of the following Questions: **2 x 6 = 12**

a) Convert the following:
i)$(11011)_2$ = ( )$_{10}$ ii)$(56)_{10}$ = ( )$_2$ iii)$(ABCD)_H$ = ( )$_2$
b) Add the following numbers by 2's compliment method:
i)$(+20)_{10}$ and $(-10)_{10}$ ii)$(-20)_{10}$ and $(-10)_{10}$
c) i) What do you mean by 1's compliment and 2's compliment of a number? Give example.
ii) Convert $(1100)_2$ into its equivalent Gray code.

Q.No.3. Answer any two of the following Questions: **2 x 6 = 12**

a) Explain NAND as universal gate.
b) Using K-map minimize the following:
Y(A, B, C, D)= $\sum(1, 3, 5, 7, 9, 11, 13, 15)$
c) Explain De Morgan's theorems.

Q.No.4. Answer any two of the following Questions: **2 x 6 = 12**

a) Explain full adder circuit with truth table and diagram.
b) Explain working of synchronous 4 bit Up counter with timing diagram.
c) Explain working of Mod-10 counter with timing diagram.

Q.No.5. Answer any two of the following Questions: **2 x 6 = 12**

a) Draw symbol, truth table of clocked Rs flip flop and explain it with timing diagram.
b) Explain JK flip flop with symbol and truth table and also draw timing diagram.
c) Explain serial in serial out shift register with timing diagram.

Q.No.6. Answer any two of the following Questions: **2 x 6 = 12**

a) Explain asynchronous 4 bit up counter and draw timing diagram.
b) Explain working of successive approximation register ADC.
c) Explain R-2R ladder DAC.

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BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

November, 2025 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**

a) For induction motor define: i) Slip ii) Pull out torque
b) Briefly explain why we need starters to start high capacity three phase induction motors.
c) State necessary conditions for connecting two alternators in parallel.
d) What do you mean by Hunting in synchronous machine? How it can be prevented?
e) What is synchronous condenser? State its application.
f) Define and briefly explain importance of voltage regulation of an alternator.
g) State two applications of: i) Universal motor ii) Permanent capacitor induction motor

Q.No.2. Answer any two of the following Questions: **2 x 6 = 12**

a) Using vector method explain how rotating magnetic field is produced in three phase induction motor.
b) With the help of neat diagram explain construction of squirrel cage induction motor.
c) A 4-pole induction motor is energized from a 50Hz supply .If the machine runs on full load at 3 percent slip, determine full load slip of the motor and frequency of rotor currents.

Q.No.3. Answer any two of the following Questions: **2 x 6 = 12**

a) With the help of power circuit and control circuit explain working of DOL starter.
b) With the help of diagram explain working of rotor resistance starter.
c) The power input of 500V, 50Hz, 3 phase squirrel cage induction motor is 50KW. If the stator losses are 2000W and friction and windage losses are 1000W and full load slip is 3 percent, calculate: i) Rotor copper losses (i) The efficiency of motor

Q.No.4. Answer any two of the following Questions: **2 x 6 = 12**

a) Compare salient pole type rotor with cylindrical pole type rotor.
b) Briefly explain how synchronous impedance can be computed by performing OC and SC test on an alternator.
c) The stator of a 3-phase, 8 pole alternator is driven at 750rpm and has 72 slots. The winding is made with 36 coils having 10 turns per coil. Calculate the rms value of the induced emf per phase if the flux per pole is 0.15Wb. Assume pitch factor to be 0.9.

Q.No.5. Answer any two of the following Questions: **2 x 6 = 12**

a) With the help of diagram explain synchronizing of alternators by 2 bright and 1 dark lamp method.
b) Why synchronous motor is not self starting? Explain the methods used to start them.

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c) A 100-KVA, 300V, 50Hz, 3-phase, Y connected alternator has effective armature resistance of 0.2 Ohms. The field current of 40A produces short circuit current of 200A and open circuit emf of 1040V line to line. Calculate the full load voltage resolution at: i)0.8pf lagging i) 0.8pf leading

Q.No.6. Answer any two of the following Questions: **2 x 6 = 12**

a) With the help of neat diagram explain construction and working of capacitor start single phase induction motor.

b) With the help of a neat diagram explain construction and working of shaded pole motor.

c) With the help of a neat diagram explain working of stepper motor. State its applications.

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BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

November, 2025 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**

a) Neatly draw and label V-I characteristics of a PN junction diode.
b) Define β of a transistor and state its relation with α.
c) State and explain Barkhausen's criterion of oscillations.
d) Define CMRR and input offset voltage w.r.t op-amps.
e) Draw the circuit diagram and relevant waveforms for a Schmitt trigger circuit using op-amp.
f) Draw the circuit diagram, input and output waveforms for a half wave rectifier circuit.
g) Define Av, Ai, Zi w.r.t small signal amplifiers.

Q.No.2. Answer any two of the following Questions: **2 x 6 = 12**

a) With a neat diagram explain the operation of zener diode as a voltage regulator.
b) Enumerate differences between photodiode and light emitting diode.
c) Draw and explain RC phase shift oscillator. Also state the expression for frequency of oscillations.

Q.No.3. Answer any two of the following Questions: **2 x 6 = 12**

a) Draw the symbol for NPN and PNP transistor. With a neat diagram explain the operation of transistor as a switch.
b) Compare common base, common emitter and common collector configurations of a transistor.
c) Explain emitter stabilized bias network giving expressions for input current, output current and output voltage. Also draw a neat circuit diagram and DC load line to support your answer.

Q.No.4. Answer any two of the following Questions: **2 x 6 = 12**

a) Differentiate between class A, B, C power amplifiers on the basis of conduction angle. Also briefly explain operation of class C power amplifier.
b) With a neat circuit diagram and waveform explain the frequency response of single stage RC coupled amplifier.
c) Enlist out some limitations of RC and LC Oscillators. Draw the circuit diagram for crystal oscillator and state the expression for frequency.

Q.No.5. Answer any two of the following Questions: **2 x 6 = 12**

a) Draw and explain block diagram of an op-amp. Also draw the diagram for DIBO.
b) With a neat diagram explain inverting amplifier. Also derive the expression for gain in inverting mode.
c) Draw the schematic diagram, equivalent circuit, symbol and pin diagram for op-amp IC741.

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Q.No.6. Answer any two of the following Questions: **2 x 6 = 12**

a) With a neat diagram explain the operation of op-amp as an adder. Support your explanation with necessary expression.

b) Draw and explain op-amp as a differentiator.

c) Draw the pin diagram and block diagram of IC555. Also explain its operation using the block diagram.

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BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

November, 2025 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**

a) List any three advantages of turbine flow meter.
b) Draw symbol of LDR and explain its principle of operation.
c) Explain measurement of pressure using diaphragm and strain gauge.
d) What is the need for signal conditioning? What is the role of AC amplifiers in signal conditioning?
e) Draw a neat block diagram of data acquisition system.
f) List any three advantages of LED display.
g) Give any three points of comparison between RTD and thermistor.

Q.No.2. Answer any two of the following Questions: **2 x 6 = 12**

a) Define transducer. Briefly explain classification of transducers.
b) Explain in brief any six characteristics of ideal transducer.
c) Explain working of: i) Low pass filter ii) High pass filter Draw their characteristics.

Q.No.3. Answer any two of the following Questions: **2 x 6 = 12**

a) With neat diagrams explain in brief resistance wire strain gauge and semi-conductor strain gauge.
b) With a neat diagram explain working of photovoltaic cell.
c) i)Explain principle of operation of thermocouple.
Ii)Draw a neat block diagram of process control system and explain function of controller block.

Q.No.4. Answer any two of the following Questions: **2 x 6 = 12**

a) With a neat diagram explain construction and operation of photoelectric tachometer for measurement of angular speed.
b) With a neat diagram explain flow measurement using electromagnetic flow meter.
c) Explain level measurement using any two capacitive methods of your choice.

Q.No.5. Answer any two of the following Questions: **2 x 6 = 12**

a) With a neat diagram explain working of strip chart recorder.
b) Explain in brief bridge circuit for RTD.
c) With a neat diagram explain working of LVDT. Draw its characteristics.

Q.No.6. Answer any two of the following Questions: **2 x 6 = 12**

a) With a neat block diagram explain SCADA system.
b) Explain any three methods for measurement of linear displacement using capacitive transducer.
c) With a neat diagram explain working of piezoelectric accelerometer.

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BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

November, 2025 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**

a) Define: i)Feeder ii)Distributor iii)Service mains
b) Briefly explain difference between system earthing and equipment earthing.
c) What is cleat earthing? Where is it used?
d) Explain the conduction mode of heat transfer and state its relevant formula for heat transfer.
e) Give three points of comparison between arc and resistance welding.
f) Explain in brief the operation of pantograph collector in traction system.
g) Define the terms: i)Candle power ii)Luminous flux iii)Lumen

Q.No.2. Answer any two of the following Questions: **2 x 6 = 12**

a) Give six points of comparison between 3Ø-3 wire and 3Ø-4 wire distribution system.
b) Drive an expression for volume of conductor material required for AC three phase three wire system.
c) Draw a neat diagram and explain ring main system. State its advantages.

Q.No.3. Answer any two of the following Questions: **2 x 6 = 12**

a) Explain SWER wiring system. State its advantages and disadvantages.
b) With the help of neat diagram explain pipe earthing.
c) Explain in brief concealed conduit wiring system. State its advantages and disadvantages.

Q.No.4. Answer any two of the following Questions: **2 x 6 = 12**

a) With the help of neat diagram explain construction and working of salt bath furnace.
b) State and explain any six desirable properties of heating element.
c) With the help of diagram explain the principle of dielectric heating and state its applications.

Q.No.5. Answer any two of the following Questions: **2 x 6 = 12**

a) With the help of neat diagram explain overhead catenary construction for tramways and trolley buses.
b) Explain in brief DC and single phase AC supply systems of electric traction.
c) With neat diagram explain spot welding and seam welding.

Q.No.6. Answer any two of the following Questions: **2 x 6 = 12**

a) Explain the principle of light production in filament and gas discharge lamps.
b) With neat diagram explain tube light circuit.
c) Compare AC welding with DC welding. (6 points)

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BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

November, 2025 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**

a) State the difference between flexible and rigid coupling.
b) What is the function of gear train?
c) State the classification of I.C engine.
d) What is meant by suction head and discharge head of a pump?
e) What is meant by C.O.P of refrigeration?
f) List common types of lubricants.
g) What is the function of super heater in boilers?
h) Differentiate between window AC and split AC.

Q.No.2. Answer any two of the following Questions: **2 x 6 = 12**

a) With a neat sketch explain bush roller chain drive and state its applications.
b) With the help of a neat sketch explain construction and working of sliding contact bearing.
c) Differentiate between spur and helical gears.

Q.No.3. Answer any two of the following Questions: **2 x 6 = 12**

a) List various components of 4 stroke diesel engine. Explain function of any four four components.
b) Differentiate between Petrol and Diesel engine.
c) Explain the following I.C. engine terminologies:
i)Stroke volume ii)Compression ratio iii)Brake power

Q.No.4. Answer any two of the following Questions: **2 x 6 = 12**

a) With the help of a neat block diagram, explain working of thermal power station.
b) Differentiate between centrifugal and reciprocating pump.
c) With the help of a neat sketch explain working of Babcock and Wilcox boiler.

Q.No.5. Answer any two of the following Questions: **2 x 6 = 12**

a) With a neat sketch explain construction and working of centrifugal pump.
b) What are refrigerants? Give some examples of commonly used refrigerants and state characteristics of a good refrigerant.
c) With a neat sketch explain working of vapour compression cycle.

Q.No.6. Write short note on any three: **3 x 4 = 12**

a) Predictive maintenance
b) Necessity of lubrication
c) Torque wrench
d) Disadvantages of 2 stroke engine

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BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

November, 2025 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**

a) With diagrams state symmetrical and unsymmetrical faults.
b) List desirable characteristics of fuse element.
c) Briefly explain current zero method of arc extinction.
d) For relay define: i) Pick up ii)Reset
e) With diagram define arc voltage and restricting voltage.
f) State the need for backup protection? How it can be achieved?
g) How are small motors protected against overload and short circuit?

Q.No.2. Answer any two of the following Questions: **2 x 6 = 12**

a) What are current reactors? State its types. Explain any one such reactor. State its advantages.
b) Two 11KV, 3-phase, 3000KVA generator having sub transient reactance of 20% are operated in parallel. The generators supply power to a transmission line through a 6000KVA transformer having a ratio of 11/22KV. It has leakage reactance of 6%. Calculate fault current and fault MVA for three phase fault on: i) HT side ii) LT side of transformer
c) Compare HRC fuse with rewirable fuse.

Q.No.3. Answer any two of the following Questions: **2 x 6 = 12**

a) For a new house, for wiring protection will you recommend fuse of MCB? Give proper justification for your choice.
b) With the help of neat diagram explain construction and working of a current operated ELCB.
c) With neat diagram explain working of air circuit breaker.

Q.No.4. Answer any two of the following Questions: **2 x 6 = 12**

a) With neat diagram explain working of MCCB.
b) With diagram explain principle of operation and construction of puffer type SFG circuit breaker.
c) With the help of diagrams explain three different types of arc controlled devices used in oil circuit breaker.

Q.No.5. Answer any two of the following Questions: **2 x 6 = 12**

a) State advantages and disadvantages of static relays. With diagram explain static differential relay.
b) With the help of diagram explain construction and working of Buchholz relay.
c) With the help of diagram explain construction and working of IDMT relay.

Q.No.6. Answer any two of the following Questions: **2 x 6 = 12**

a) With diagram explain how over current and earth fault protection be provided for induction motors.
b) With neat diagram explain earth leakage protection for bus bar.
c) With neat diagram explain current graded protection for transmission line. State its advantages and disadvantages.

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BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

November, 2025 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**

a) Draw the symbol for GTO. Also state its function and application.
b) With a neat diagram briefly explain the concept of freewheeling diode.
c) Briefly explain the operating principle of cycloconverter.
d) List any three drawbacks of basic series inverter.
e) Define Chopper. Draw the circuit diagram for class A chopper.
f) Draw the schematic diagram for VFD.
g) Draw a neat diagram for SMPS. Also label the blocks.
h) List the methods of speed control for AC motors.

Q.No.2. Answer any two of the following Questions: **2 x 6 = 12**

a) Differentiate between SCR, DIAC and TRIAC.
b) What is meant by commutation in SCR? List the various commutation methods and explain any one method in detail.
c) Draw VI characteristics of SCR. Neatly label it and also define Holding current and Latching current.

Q.No.3. Answer any two of the following Questions: **2 x 6 = 12**

a) Explain the operation of single phase full wave controller with resistive load. Draw the circuit diagram and input, output waveforms.
b) With a neat diagram and waveforms explain the operation of single phase half wave converter with RL load.
c) Write a short note on single phase dual converter with RL load.

Q.No.4. Answer any two of the following Questions: **2 x 6 = 12**

a) With a neat diagram explain the operation of Buck regulator.
b) With the help of a neat circuit diagram and relevant waveforms explain F/2 generating cycloconverter with centre tapped configuration.
c) List the various turn ON methods of SCR. Explain any one in detail.

Q.No.5. Answer any two of the following Questions: **2 x 6 = 12**

a) With a neat diagram explain two quadrant chopper drive.
b) Elaborate on single phase full wave bridge inverter.
c) With the aid of a neat circuit diagram explain how class B chopper operates.

Q.No.6. Answer any two of the following Questions: **2 x 6 = 12**

a) With the help of a neat block diagram explain the concept of electric drive system using power electronic converter.
b) Write a short note on static Kramer's drive.
c) Explain static rotor resistance control using chopper.

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BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

November, 2025 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**

a) Define the terms: i)Danger ii)Hazard iii)Safety
b) What are the basic principles of electrical safety?
c) Explain the principle of extinguishing fire.
d) Classify burns according to the degree of injury to body tissue.
e) What is? i)System grounding ii)Equipment grounding
f) Define: i)Creepage distance ii)Clearance to earth
g) What do you mean by flashoner and corona discharge associated with electrical equipment and plant?

Q.No.2. Answer any two of the following Questions: **2 x 6 = 12**

a) State and explain the hazards associated with electric current and voltage.
b) State the possible conditions when a person may get an electric shock, also list the factors which decides the severity of electric shock.
c) State the safety procedures to be adopted in electrical plants.

Q.No.3. Answer any two of the following Questions: **2 x 6 = 12**

a) What remedial measures are to be taken in a situation wherein a person is choking?
b) Give a list of activities to be performed after an electric shock to a person at site.
c) With a neat diagram of artificial resuscitator explain the method of artificial respiration.

Q.No.4. Answer any two of the following Questions: **2 x 6 = 12**

a) What are the key components and design considerations of an earthing system in an electrical substation?
b) Explain step potential and touch potential.
c) What is section clearance? What are the standard clearances required in an electrical substation? Provide a diagram illustrating a typical section clearance.

Q.No.5. Answer any two of the following Questions: **2 x 6 = 12**

a) List the responsibilities of authorizing party and operating party in electrical and fire safety.
b) Explain control of work permit.
c) What are key safety aspects to be considered during recommissioning after major maintenance and repair work?

Q.No.6. Answer any two of the following Questions: **2 x 6 = 12**

a) State and explain IE Rule 32 along with its relevant sub-rules.
b) State and explain IE Rule 80 along with its relevant sub-rules.
c) Write a short note on safety organization.
d) State and explain the classification of hazardous zones and selection of equipments suitable for each zone.

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BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

November, 2025 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**

a) With an example explain multimotor drive. State any two advantages of it.
b) Draw symbols and state function of: i) Push button ii) Time delay relay
c) Briefly explain the concept of v/f speed control method for a three phase induction motor.
d) Which type of motor should be best suited for the application of refrigeration? State and justify your choice.
e) List any six factors governing selection of motor for an application.
f) With a neat diagram explain the working of limit switch.

Q.No.2. Answer any two of the following Questions: **2 x 6 = 12**

a) With a neat labelled diagram and relevant characteristics explain four quadrant operation of a drive motor with an example of hoist load.
b) What do you mean by stability? Explain steady state stability and state the criteria for steady state stability.
c) Using joint–speed-torque characteristics explain how stability of a drive motor and the load can be determined.

Q.No.3. Answer any two of the following Questions: **2 x 6 = 12**

a) With the help of neat connection diagram and relevant characteristics explain dynamic braking of DC shunt motor.
b) List the three main methods of electrical braking. Briefly explain the concept of each of these methods.
c) What do you mean by regenerative braking? What are the conditions to be satisfied for regenerative braking to take place in three phase induction motor? Explain the speed-torque characteristics for regenerative braking in three phase induction motor.

Q.No.4. Answer any two of the following Questions: **2 x 6 = 12**

a) With the help of neat connection diagram and characteristics explain the rotor rheostat method of speed control applied for three phase induction motor.
b) With neat diagrams explain the consequent pole method for speed control of three phase induction motor.
c) State and explain types of enclosures used for motors as per IS 4722.

Q.No.5. Answer any two of the following Questions: **2 x 6 = 12**

a) The three phase induction motor has to perform following duty cycle: i) 35KW for 3mii i) 15KW for 20min iii) 35KW for 2min iv) 10?KW for 15min
This cycle is repeated indefinitely. Determine the capacity of continuously rated motor.
What will be the new capacity of the motor if between the operating periods of: ii) and iii) there is a rest period of 20 min. and after iv) there is another rest period for 15min.

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b) Draw corresponding curves and explain:
i)Short time duty (ii) Intermittent periodic duty

c) With neat diagram explain the working and state function and draw the symbol of: i) Overload relay ii) Float switch

Q.No.6. Answer any two of the following Questions: **2 x 6 = 12**

a) Draw and explain power circuit and control circuit for motor fed from two alternate sources of supply.

b) Draw control diagrams and explain working of :
i)Interlocking control ii) Sequential control with time delay

c) Select a suitable motor and support your selection with valid reasons for the following applications:
i)Machine tools ii) Water pump iii) Cranes

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BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

November, 2025 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**

a) Explain individual proprietorship organisation.
b) What supervisory skills are required in the industry?
c) What are the various reasons for obsolescence?
d) What do you understand by conciliation?
e) Calculate the expected time (te) of an activity in PERT analysis, if (t_o) optimistic time is 10 days, pessimistic time (t_p) is 12 days and most likely time (t_m) is 11 days.
f) What is a group incentive plan?

Q.No.2. Answer any two of the following Questions: **2 x 6 = 12**

a) Explain functional organization with a neat sketch.
b) State the advantages and disadvantages of a partnership organization.
c) Explain the concept of management and administration.

Q.No.3. Answer any two of the following Questions: **2 x 6 = 12**

a) Explain the following functions of management:
i)Organizing ii) Coordinating
b) Write a note on store-keeping function in the industry.
c) Explain break-even analysis with the help of a nest sketch.

Q.No.4. Answer any two of the following Questions: **2 x 6 = 12**

a) Explain the various sources if finance.
b) Explain 'ABC Analysis' in materials management with a neat sketch.
c) i) What do you understand by depreciation?
ii) A machine was purchased for Rs.48,000. The life of the machine was estimated to be 12 years and the scrap value as Rs.12,000. Use the diminishing balance method to calculate the rate of depreciation.

Q.No.5. Answer any two of the following Questions: **2 x 6 = 12**

a) Explain the training function of personnel department.
b) Differentiate between time rate wage system and piece rate wage system.
c) Write a note on The Factories Act 1948.

Q.No.6. Answer any two of the following Questions: **2 x 6 = 12**

a) What is a grievance? Explain briefly the steps involved in settlement of disputes of employees.
b) i) What do you mean by Just in Time system?
ii) Differentiate between CPM and PERT.

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c) The activity details and their predecessor are given below along with their activity times:

Activity	Predecessor	Activity Time (days)
A	-	5
B	A	8
C	B	6
D	A	5
E	D	4
F	C,E	6

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

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BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

November, 2025 Examinations

Programme: **Electrical Engg.**

Subject: **Testing & Maint. of Electrical Machines (EL618)**

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) What is the routine test for an electrical machine?
b) Explain how a Resistance Temperature Detector (RTD) is used to measure the temperature rise in an electrical machine.
c) Justify the statement: 'Generally large capacity machines are tested by indirect method of testing'.
d) The measured values of resistance at the line terminal of star delta connected transformer are 3Ω and 2Ω respectively. What will be the resistance per phase of primary and secondary winding?
e) List down at least six types of tests to be performed on 3-phase induction motors.
f) List the various tests to be performed on synchronous machines.
g) State the various methods of revarnishing of winding of electrical equipments.

Q.No.2. Answer any two of the following Questions: **2 x 6 = 12**

a) For a DC machine define: i) Mechanical efficiency ii) Electrical efficiency iii) Overall efficiency
b) A 500V DC shunt motor takes 4A on no load. The armature resistance including that of brushes is 0.2Ω and the field current is 1A. Estimate the output and the efficiency when the input current is: i) 20A ii) 100A
c) With a neat diagram explain the procedure for determination of efficiency of a DC machine using the brake test.

Q.No.3. Answer any two of the following Questions: **2 x 6 = 12**

a) Explain the high voltage test on the power transformer.
b) With a neat diagram explain the O.C and S.C test to be performed on a transformer to determine its efficiency and losses.
c) Explain the measuring of insulation resistance. How is it measured for power transformers?

Q.No.4. Answer any two of the following Questions: **2 x 6 = 12**

a) With a neat labelled diagram, explain how Sumpner's test is performed on transformers to find efficiency.
b) State and explain the acceptance test to be performed on 3-phase induction motor. Why these tests are necessary?
c) Explain blocked rotor test on 3 phase induction motor in detail.

Q.No.5. Answer any two of the following Questions: **2 x 6 = 12**

a) Explain determination of efficiency of induction motor by summation of losses method.

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b) The input power to a 500V, 50Hz, 6 pole, 3 phase induction motor running at 975rpm is 40KW. The stator losses are 1KW and friction and windage losses total 2KW. Calculate: (i) Slip ii) Rotor Copper loss iii) Output power in HP iv) The efficiency

c) Explain how the efficiency of synchronous machine can be determined by using summation of losses method.

Q.No.6. Answer any two of the following Questions: **2 x 6 = 12**

a) Explain the maintenance schedule of transformer as per IS.

b) Explain the different steps to be taken for care of electrical equipment during periods of inactivity.

c) What are the common causes of failure in induction motor and how can these issues be effectively troubleshooted?

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BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

November, 2025 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**

a) Explain concept of demand side management. Give any two reasons why it is required.
b) Differentiate between preliminary energy audit and detailed energy audit.
c) List down the causes for poor power factor?
d) Define the terms: i) Room index ii) Colour rendering index.
e) List any three technical aspects of energy efficient motors.
f) Briefly explain how energy efficient transformer contributes to improved efficiency of transformer.
g) Define i) motor loading ii) total developed head w.r..t pumps.

Q.No.2. Answer any two of the following Questions: **2 x 6 = 12**

a) List any six causes for poor power quality and state its effects on the performance of machinery.
b) What is energy conservation? Describe the energy strategy for future.
c) Elaborate on the action taken at various levels on the supply side to manage energy.

Q.No.3. Answer any two of the following Questions: **2 x 6 = 12**

a) Outline the ten steps methodology for detailed energy audit.
b) Write a note on instruments used for energy audit.
c) Explain the step by step approach for maximum demand control.

Q.No.4. Answer any two of the following Questions: **2 x 6 = 12**

a) Describe and state advantages and disadvantages of:
i) Block rate tariff ii) Maximum demand tariff
b) A factory has a maximum load of 240KW at 0.8pf lagging with an annual consumption of 50,000 units. The tariff is Rs.75 per KVA of maximum demand plus 25paise per unit. What will be the annual saving in the energy bill if the power factor is raised to unity?
c) A 3 phase 5KW induction motor has a power factor of 0.75 lagging. A bank of capacitors is connected in data across the supply terminals and the power factor raised to 0.9 lagging. Determine the KVAR rating of the capacitors connected in each phase.

Q.No.5. Answer any two of the following Questions: **2 x 6 = 12**

a) Assess the lighting scheme for a commercial application by calculating the ILER. Dimension of an interior are 8mx4mx2m. Total circuit Watts when wattmeter is installed in lighting feeder is 800W. Average maintained illuminance at 18 measurement points is 700Lux. Assume target Lux/W/m^2 as 46
b) Explain step by step method for lighting performance assessment.
c) Explain the procedure for pump efficiency assessment.

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Q.No.6. Answer any two of the following Questions: **2 x 6 = 12**

a) With respect to energy efficient lighting controls, explain:
i) Time based control ii) Daylight linked control

b) Explain the concept of variable frequency drive.

c) Differentiate between conventional ballast and electronic ballast.

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BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

November, 2025 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**

a) Draw symbol and state function of the following:
i)Circuit breaker ii) Earthing switch

b) Define ratio error and phase angle error for CT.

c) Briefly explain earthing mat used in substations.

d) State any three objectives of tariff.

e) Explain trickle charging of batteries.

f) Draw a neat diagram showing 1 & ½ breaker bus bar arrangement.

g) Give three points of comparison between power and control cables.

Q.No.2. Answer any two of the following Questions: **2 x 6 = 12**

a) Compare indoor substation with outdoor substation.

b) Draw a neat single line diagram of 11KV/400V pole mounted substation and explain each component in brief.

c) What do you mean by mimic diagram? Compare corridor type and cubicle type CR panel.

Q.No.3. Answer any two of the following Questions: **2 x 6 = 12**

a) With a neat diagram explain single sectionalized bus bar arrangement. State its advantages and drawbacks.

b) With a neat diagram explain working of clamp on ammeter.

c) With a neat diagram, explain working of metal oxide lightening arrestors.

Q.No.4. Answer any two of the following Questions: **2 x 6 = 12**

a) With a neat phasor diagram explain solid earthing. State any two drawbacks of the same.

b) List out the safety precautions to be followed while carrying out work in substation.

c) i) What are the permissible values of earthing resistance for large, major and small substations?
ii) Explain in brief the process of reactivation of silica gel.

Q.No.5. Answer any two of the following Questions: **2 x 6 = 12**

a) State and explain disadvantages of low power factor.

b) Explain in brief: i) Simple rate tariff ii) Power factor tariff

c) A 3 phase, 5KW induction motor has a power factor of 0.7 lagging. A bank of capacitors is connected in delta across the supply terminals and power factor is raised to 0.9 lagging. Determine KVAR rating of capacitor connected in each phase.

Q.No.6. Answer any two of the following Questions: **2 x 6 = 12**

a) Briefly explain factors affecting current carrying capacity of underground cables.

b) With a neat diagram explain construction of 3 core PVC cable.

c) State any three points of difference between: i)CT and PT
CT for measurement and CT for protection

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BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

November, 2025 Examinations

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

Subject: **PLC in Automation (MC612)**

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) Explain in brief application of automation in:
i)Medical field ii)Automobiles

b) List any three advantages of automation

c) Draw ladder diagrams for OR and NAND logic.

d) Draw a ladder diagram for two motor conveyor system with following conditions:
i)Start push button starts Motor 1 and Motor 2
ii)Stop push button stops Motor 1 immediately and Motor 2 stops after 10 seconds

e) Write a program to count number of boxes on a conveyor belt. Once 50 boxes are counted, a siren should be activated.

f) Explain any three maintenance guidelines for PLC.

g) Explain the use of master control relay in PLC.

Q.No.2. Answer any two of the following Questions: **2 x 6 = 12**

a) Explain in brief PLC's CPU scan.

b) Write a short note on PLC's memory.

c) What is the function of PLC's output module? List any six output devices used with PLC and state their uses.

Q.No.3. Answer any two of the following Questions: **2 x 6 = 12**

a) State the advantages of PLC control system.

b) Draw a ladder diagram to implement following function:
$Y = (a, b, c) = \pi (0, 2, 4)$

c) Explain 'count up counter' function using a ladder diagram.

Q.No.4. Answer any two of the following Questions: **2 x 6 = 12**

a) List the number conversion functions in PLC's instruction set. Explain any one of your choice with a ladder diagram.

b) Draw neat ladder diagrams and explain:
i)'Greater than' function ii)Addition function

c) Draw a ladder diagram for 4:1 multiplexer.

Q.No.5. Answer any two of the following Questions: **2 x 6 = 12**

a) Draw a ladder diagram to control a stepper motor:
i)Stepper input pulse is 1 second ON and 1 second OFF
ii)When input pulse is ON, stepper motor moves by one step
iii)When motor moves 20 steps, it should be still for 20 secs
iv)Cycle should repeat

b) Draw a ladder diagram for controlling three motor conveyor system in following sequence:
i)Motor M1 to be started when push button PB1 is actuated
ii)After 20 sec, M2 to be energized
iii)After another 10 secs, M3 starts
iv)Entire system to stop when STOP button PB2 is activated

c) Draw a ladder diagram for a bottle filling plant with following conditions:

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i)Small sized bottles are filled by filler 1 for 30 secs and large sized bottles are filled by filler 2 for 35 seconds
ii)Upon filling, bottles are capped by capping machines C1 and C2 respectively. Capping machines take 15 secs to do the task
iii)Start push button is used to start the process by turning ON conveyer belt meter M1

Q.No.6. Answer any two of the following Questions: **2 x 6 = 12**

a) Explain the need of automation.
b) Draw a ladder program for two floor basic elevator control system.
c) Write short note on trouble shooting of ladder program.

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