BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

November, 2025 Examinations

Programme: **Mechanical Engg.**

Subject: **Energy Conversion (MC405)**

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 important uses of compressed air.
b) List any three important engine parts and state their functions.
c) Define brake power, indicated power and mechanical efficiency.
d) State any three differences between petrol and diesel engine.
e) Write any three differences between 2 stroke and 4 stroke engine.
f) List any three components of a thermal power plant.
g) State any three advantages of a hydro-electric power plant.

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

a) Explain briefly with a neat sketch, the construction and working of a reciprocating compressor.
b) Define the following terms:
i)Free air delivered ii)Piston displacement iii)Indicated power iv)Capacity of compressor
c) Explain the Otto cycle with the help of P-V diagram.

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

a) With a neat sketch, explain the construction and working of a 4 stroke diesel engine.
b) Draw a labelled schematic flow diagram of cooling, lubrication and fuel system of an IC engine.
c) Explain valve timing diagram of a 4 stroke petrol engine with a neat sketch.

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

a) Explain with a neat sketch the steam pressure-velocity graph, principle and working of an impulse turbine.
b) Describe the different methods of compounding in steam turbines.
Explain the velocity compounding with a neat diagram.
c) Write down the functions of steam nozzle and explain different types of steam nozzles.

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

a) With a neat layout diagram, explain the working of a hydroelectric power plant.
b) Explain the layout, construction and working of a nuclear power plant with a neat sketch.
c) With a neat diagram, describe the layout and working of a gas turbine power plant.

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

a) Draw labelled sketches of solar water heater and solar still.
b) Describe the basic components of a wind energy conversion system and explain their functions.
c) Write a short note on any one biomass conversion technology.

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17/11/2025 9:30 AM TO 12:30 PM

BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

November, 2025 Examinations

Programme: **Mechanical Engg./SB**

Subject: **Elements of Electrical And Electronics Engg. (CC302)**

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 the necessity of earthing.
b) Explain the function of MCB.
c) State any three applications of a transformer.
d) State any three applications of D.C. series motor.
e) Write colour codes of three phase PVC cables.
f) Draw the symbol of: i) NPN transistor ii) PNP transistor iii) PN junction diode

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

a) With a neat labelled diagram, explain pipe earthing.
b) Explain the 'surface conduit wiring system' with neat diagram. Also list out its two advantages.
c) Explain any three advantages and any three disadvantages of underground distribution system over overhead distribution system.

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

a) Draw the symbol and state the functions of:
i)MCCB ii) Fuse-switch unit iii) Switch –fuse unit
b) With a neat diagram, explain the construction and operation of an electromagnetic relay.
c) With a neat diagram, explain the construction of HRC fuse.

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

a) Compare a core type transformer with a shell type transformer.
b) Name and explain the functions of all main parts of a squirrel cage induction motor.
c) With a neat sketch explain the construction of transformer.

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

a) With neat diagram, explain working principle of D.C motor.
b) With the help of neat diagram, explain methods of reversal of direction of rotation of D.C shunt and D.C series motor.
c) With neat diagram, explain slip ring induction motor in detail.

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

a) Draw the symbol and write the truth tables of:
i) NOT ii) NOR iii) X-OR
b) Convert the following decimal numbers to binary:
i) $(115)_{10}$ ii) $(127.5)_{10}$ iii) $(86.25)_{10}$
c) Write a short note on N-type semiconductor.

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BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

November, 2025 Examinations

Programme: **Mechanical Engg.**

Subject: **Mechatronics (MC403)**

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) Difference between traditional and mechatronic system.
b) What are dynamic characteristics of sensor? Explain any one dynamic characteristic of sensor.
c) Difference between sensor and transducer.
d) Draw a neat sketch of a gear motor.
e) What is the purpose of void loop and void setup function in Arduino programming?
f) Write a short note on PLC sizes.
g) Write ladder program for AND and OR logic.

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

a) Explain various areas of application of mechatronics.
b) With the help of a suitable example of any mechatronic system, explain the basic block diagram of mechatronic system.
c) With a neat sketch, explain working of optical encoder.

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

a) Explain data acquisition system with a neat block diagram. Also stable its applications.
b) With a neat sketch, explain working of LVDT sensor.
c) Give detailed classification of sensors.

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

a) List the advantages, limitations and application of pneumatic actuation system.
b) Explain the working principle of relay with a neat sketch.
c) With a neat sketch, explain working of pressure relief valve. Also draw its pneumatic symbol.

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

a) Explain characteristics of microcontroller in detail.
b) Write a Arduino program for following scenario.:
An LED is connected to pin 7. The LED should glow for 10 seconds and then go off for 2 seconds. Further, The process repeats.
c) Draw PIN Layout of Arduino UNO R3 board. What are the different methods of powering Arduino UNO R3 board?

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

a) Draw block diagram of PLC and explain various components.
b) Write a ladder program for following scenario. After pressing an ON button, an alarm should sound. The alarm should continue for 60 seconds and then go off. If an OFF button is pressed while the alarm is on, then also the alarm should go off.
c) Explain the concept of interlock in ladder programming with suitable example.

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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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14/11/2025 - 9.30 to 12.30 Pm

14/11/2025 2.00 Pm to 5 Pm

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

adhesives used in food packaging.

...2/-

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

Only for Mechanical Engg. & allied branches:

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

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:

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

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: **Mechanical Engg.**

Subject: **Automobile Engineering (MC622)**

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) Why is monocoque chassis preferred in cars?
b) List he features of a CRDI system. (any two)
c) Compare the constant mesh gear box with the sliding mesh gear box.
d) How is a battery rated?
e) State any two important features of ABS.
f) How is a sedan different from a hatchback? (Give any two points of differentiation)
g) List the use of the following: i)Collapsible steering ii) Seat belt

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

a) Giving neat sketch explain the construction and working of a fluid flywheel.
b) With the help of a neat sketch explain how various gear ratios are achieved in a sliding mesh gear box.
c) Define: i) Castor ii) Camber iii) Wheel base iv) Toe-in

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

a) List the various loads acting on a vehicle frame and their effects.
b) Give a neat schematic diagram of the hydraulic brake system and describe its construction and working.
c) Write the salient features of BS –VI norms as applicable to diesel vehicles and petrol vehicles.

OR

c) Giving neat sketch explain the construction and working of an automobile air conditioning system.

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

a) List any six important sensors used in the fuel system of an automobile and state their uses.
b) Discuss the salient features of: i)EFI ii) TBI
c) What function does a clutch perform in an automobile? Compare a dry clutch with a wet clutch.

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

a) With the help of a neat sketch explain the construction and working of the McPherson strut type suspension system.
b) Explain giving neat sketch the constructional features and working of the rack and pinion steering system.
c) Explain with a neat sketch the construction and working of a Bendix drive.

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

a) Simple carburetor
b) Voltage regulator
c) Mechanical brake system
d) Engine management system

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BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

November, 2025 Examinations

Programme: **Mechanical Engg./A**

Subject: **Thermal Engineering (MC303)**

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.
4) Use of Steam Tables and Mollier's Charts is Permissible.

Q.No.1. Answer any five of the following Questions: **5 x 3 = 15**

a) Explain the following modes of heat transfer: i) Conduction ii) Convection

b) State and explain Clausius statement of second law of Thermodynamic.

c) Differentiate between boiler mountings and boiler accessories. Name at least two mountings.

d) State difference between water tube boiler and fire tube boiler.

e) Give at least three functions of steam condenser.

f) Define: i) Wet steam ii) Dry and saturated steam

g) State Boyle's Law and Gay Lussac's law.

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

a) State and explain different types of thermodynamic system. Give an example of each.

b) Define the following terms and state their units:
i)Enthalpy ii) Entropy iii) Internal energy

c) A domestic food freezer is to be maintained at a temperature of -20°C. The ambient air temperature is 35°C. If the heat leaks into the freezer at a continuous rate of 2 KJ/s, find the power required to pump this heat out continuously.

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

a) Explain the construction and working of economiser with the help of neat sketch.

b) A heat pump delivers 60000KJ of heat per minute to a conditioned space. If the space is maintained at 30°C and the ambient temperature is 15°C, find the following: i) COP of the heat pump ii) Amount of heat drawn from surrounding is KW iii) Power required to drive the heat pump in KW

c) A cold storage is maintained at -8°C while the surroundings are at 40°C. the heat leakage from the surroundings into the cold storage is estimated to be 35KW. The actual C.O.P of the refrigeration plant is one third of an ideal plant working between the same temperatures. Find the power required to drive the plant.

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

a) A certain gas occupies $0.2m^3$ at a temperature of 25°C and a pressure of 1.2 bar. If the gas has a mass of 0.3Kg, calculate the value of gas constant and molecular mass of the gas.

b) A vessel of capacity $6m^3$ contain 22Kg of an ideal gas having a molecular mass of 27. If the temperature of the gas is 20°C, find its pressure.

Take universal gas constant= $8.314 \frac{KJ}{Kmol.K}$

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c) A certain quantity of air has volume of $0.028m^3$ at a pressure of 1.5 bar and 30°C. It is compressed to a volume of $0.0042m^3$ according to the law $PV^{1.3}$=constant. Find the final temperature and work done during compression.

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

a) With the help of neat sketch, explain the construction and working of Barrel calorimeter.

b) With the help of neat sketch, explain the construction and working of blow-off cock.

c) Determine the condition of steam:
i)Steam at 12 bar and volume $0.14m^3/Kg$
ii)Steam at 20 bar and temperature 250°C
iii)Steam at 25 bar and enthalpy of 2520KJ/Kg

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

a) Explain with a neat sketch, construction and working of parallel flow heat exchanger.

b) Explain with a neat sketch construction and working of evaporative condenser.

c) The inner surface of plane brick wall which is 250mm thick is at 40°C and outer surface is at 20°C. Calculate the rate of heat transfer per m^2 of the surface area of the wall. Thermal conductivity of brick is 0.52 W/m•°C.

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BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

November, 2025 Examinations

Programme: **Mechanical Engg./A**

Subject: **Fluid Machinery (MC404)**

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) Density ii) Viscosity
b) Determine the mass density and specific weight of a liquid whose specific gravity is 0.9.
c) How pressure measuring devices are classified?
d) Define: i) Hydrostatic pressure ii) Hydrostatic law
e) What is the function of air vessel in reciprocating pump?
f) State Bernoulli's theorem and write its equation of heads.
g) What are the main components of impulse and reaction turbine?
h) What is priming and why it is necessary?

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

a) Convert a pressure of 0.5Kg/cm^2 into corresponding pressure head of: i) Water ii) Kerosene (SG=0.8) iii) Mercury (SG=13.6)
b) As shown in fig.1. pipe-A contains carbon tetrachloride of specific gravity 1.6 under a pressure of 103KN/m^2 and pipe-B contain oil of SG=0.8 with a pressure of 172 KN/m^2. Find the difference in the level of mercury between two limbs.
c) A circular plate of diameter 1.6m is place in such a way that the centre of the plate is 3.2m below the free surface of water. Determine TPF and Center of Pressure. (CP)

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

a) The diameter of pipe at section 1-1 and 2-2 are 100mm and 250mm respectively. If the discharge through the pipe is $0.06\frac{m^3}{s}$, find average velocities at the two sections.
b) A rectangular plate 2m wide and 4m deep is immersed in water in such a way that its plane makes an angle of 25^0 with the water surface. Determine TPF and C.P.
c) A pipe of 250mm diameter carries an oil of specific gravity 0.8 at a rate of 0.13m^3/s and under a pressure of 3KPa. Find the total energy 3m above datum line.

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

a) A 200mmx120mm ventturimeter is installed in a horizontal pipe charring oil of SG=0.8. If mercury differential manometer shows a reading of 200mm, find the discharge through the pipe.(Take C_d=0.98)
b) A jet of water issues from an orifice of diameter 20mm under a head of 1.2m. Find the coefficient of discharge for the orifice, if the actual discharge is 0.94lit/sec.
c) Water is flowing through a pipe 1.5Km long with a velocity of 1.5m/s. What should be the diameter if the head lost due to friction is 10m?tTake coefficient of friction f=0.01.

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Q.No.5. Answer any two of the following Questions: **2 x 6 = 1**

a) What is a hydraulic turbine? Differentiate between impulse and reaction turbine.

b) With neat sketch explain the constructional and operational details of Francis turbine.

c) Draw general layout of hydroelectric power plant using an impulse turbine and explain.

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

a) Differentiate between: i) Centrifugal and reciprocating pump ii) Pump in series and Pump in parallel

b) Explain in brief: i) Slip and negative slip in Reciprocating pump ii) Cavitation's in centrifugal pumps

c) With the help of neat sketch, explain in brief: i) Rotary vane pump ii) Hydraulic accumulator

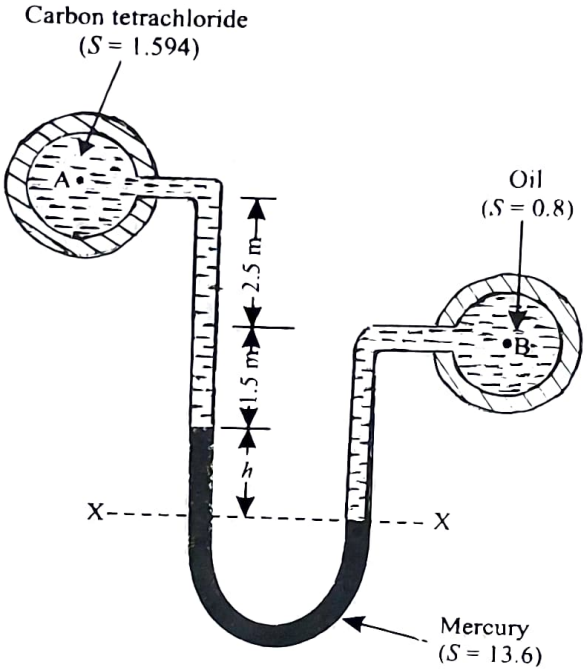

FIG. 01 Q.No 2b

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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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3 x 4 = 12

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

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.

3 x 4 = 12

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

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.

3 x 4 = 12

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

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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11/11/2025 2:00 PM TO 5:00 PM

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: **Mechanical Engg.**

Subject: **Machine Design(MC601)/Machine Design Practice(ME601) [Rat/Rev]**

Time Duration: **4 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.
4) Use of Standard Data Sheet is Permissible.

Q.No.1. Answer any five of the following Questions: **5 x 3 = 15**

a) Define endurance limit and creep.
b) What is factor of safety? Which factors influence the selection of factor of safety.
c) Explain the meaning of following material designation: i)Fe360 ii)30C10 iii)FG250
d) What are the applications of knuckle joint?
e) What are the requirements of a good coupling?
f) What is Wahl's stress concentration factor? Why is it considered in design of springs?
g) Mention different thread profiles used in power screws. Sketch any three thread profiles.
h) What are the effects of cutting keyways in a shaft?
i) A rolling contact bearing is designated as '6318'. Explain its meaning.
j) Mention various colours and their meanings in the context of aesthetic considerations in design. **(Only for students of Rationalized scheme)**

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

a) Explain the procedures used in design of machine components i.e. the machine design procedure.
b) Design a knuckle joint to connect two rods subjected to a maximum axial load of 70KN. The permissible stresses for all the components may be taken as 80Mpa in tension, 40Mpa in shear and 130Mpa in crushing.
c) The load acting on a C-clamp is shown in fig.1. Assuming b=3t, determine the dimensions of the clamp if allowable stress is 85Mpa.

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a) With neat diagram, Explain 'Pipe Earthing'.
b) With a neat diagram, explain the principle of operation of Miniature Circuit Breaker. (M.C.B)
c) Define minimum fusing current, breaking capacity, voltage rating and current rating of fuse.

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i)Small sized bottles are filled by C
sized bottles are filled by fi
ii)Upon filling, bottle
and C2 respec
the task
iii)C

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

a) A pulley has 4 arms of elliptical cross-section with the major axis twice as the minor axis. Pulley transmits 30KW at 950rpm and has a mean diameter of 300mm. Design the arms of the pulley if the permissible stress for pulley material is 18Mpa.

b) What do you mean by bolt of uniform strength? How such bolts can be obtained?

c) Find the diameter of solid shaft to transmit 30KW at 300rpm. The shear strength of the material is 450Mpa and FOS= 1.5. If a hollow shaft is used in place of solid shaft, find the diameter of hollow shaft if the ratio of diameters $d_o/d_i = 2.5$

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

a) A welding joint between plates of 12 mm thickness is shown in Fig (2). The permissible tensile and shear stresses in the weld are 120mpa and 65mpa respectively. Find the length of each parallel fillet weld.

b) A bracket is assembled to the column with help of 4 bolts as shown in fig.3. All bolts are identical. For the eccentric load applied, determine bolt site if allowable shear stress is 90Mpa.

c) Design a helical valve spring for operating between a load range of 120N-160N. The deflection of the spring for the load range is 10mm. Assume spring index=6 and allowable shear stress for spring material as 400Mpa. Take modulus of rigidity as 84×10^3Mpa. Wahl's stress concentration factor is defined as:

$\frac{4C-1}{4C-4} + \frac{0.615}{C}$, where C is spring index

Design the spring and mention its specifications. Consider plain ends for the spring.

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

a) A flat sunk key is used to connect pulley to a 50mm diameter shaft. The standard cross section of the key is 14mm x 9mm. Allowable crushing and shear stresses are 140Mpa and 45Mpa respectively. Determine length of the key to transmit 25KW at 450rpm, by this keyed joint.

b) Design a muff coupling to connect two shafts transmitting 20KW at 240rpm. The permissible material stresses for shaft and key are 55Mpa in shear and 150Mpa in crushing. The permissible shear stress for the sleeve is 20Mpa. Consider an overload of 15%.

c) Explain the procedure for selection of rolling contact bearing from the manufacturer's catalogue.

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

a) A power screw has 6mm pitch and 40mm diameter. The screw is subject to an axial load of 6KN. The nut length is 12mm. Determine: i) Bearing pressure between the threads ii) Shear stresses in the threads due to axial load iii) Compressive stresses in the screw

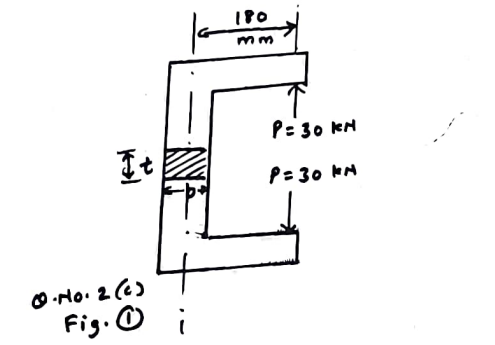
b) Explain man-machine relationship with the help of a man-machine closed loop system with respect to ergonomic consideration in design. **(Only for students of Rationalized scheme)**

c) Design a helical compression spring to carry a load of 80N. Deflection of spring is 30mm and spring index C=10. Wahl's stress concentration factor is given as:

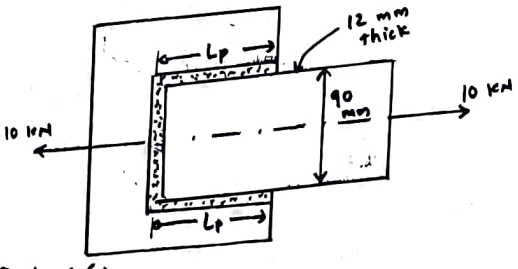
$$\frac{4C-1}{4C-4}+\frac{0.615}{C}$$

Assume permissible shear stress as 200Mpa and modulus of rigidity as 85 x 10^3 Mpa. Consider square and ground ends.

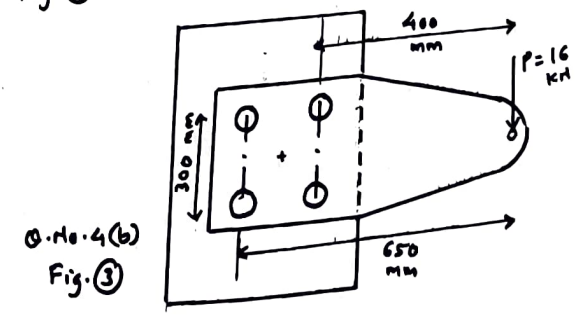
d) A leaf spring has 12 leaves, two of which are full length leaves. The spring supports are 1.2m apart and central band is 80mm wide. Central load on spring is 8KN. Determine thickness and width of spring leaves if the allowable stress is 400Mpa. The ratio of total depth to width is 3:1. Also find spring deflection. Take E=210 x 10^3Mpa. **(Only for students of Revised scheme)**



Q.No. 2(c)
Fig. ①



Q.No. 4 (a)
Fig. ②



Q.No. 4(b)
Fig. ③

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BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

November, 2025 Examinations

Programme: **Mechanical Engg./A**

Subject: **Manufacturing Processes (MC302)**

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 types of moulding sand used in foundry. Explain any two with their properties.

b) What are the different types of gas welding flames? Explain any two with their applications.

c) Differentiate between open die forging and close die forging with suitable examples.

d) Explain any two operations performed on a centre lathe with the tools used for each.

e) What is a reamer and how is it different from a drill?

f) What are the different types of drilling machines? Give features of any one.

g) What is a pattern in foundry and why is it important?

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

a) What is the significance of pattern allowances in foundry? Discuss its types.

b) Describe the working principle and operation of pressure die casting. Also discuss the common defects associated with this casting method.

c) Describe the construction and working of a cupola furnace..

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

a) Explain the manual metal arc welding process. Give the applications of the same.

b) With a neat sketch, explain the working of gas welding process.

c) Differentiate between soldering and brazing. (at least 3 points)
Give the applications of soldering, brazing and welding

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

a) Explain any three processes used in sheet metal work.

b) Explain the construction of column and knee type milling machine.

c) Explain any three types of drilling operations.

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

a) Draw a neat sketch of the centre lathe and describe the functions of a tail stock.

b) List the different types of milling cutters and explain the features of any two with neat sketches.

c) Explain the following milling operations with neat sketches:
i)Gang milling ii) Angular milling

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

a) Explain feed and depth of cut in context with centre lathe.

b) Explain the function of a carriage, headstock and a head crew of a centre lathe.

c) Explain the working principle of a hydraulic press with a neat sketch.

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BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

November, 2025 Examinations

Programme: **Mechanical Engg./A/SB**

Subject: **Strength of Materials (MC401)**

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 shear stress and shear strain.
b) Draw a stress-strain curve for a ductile material and label elastic limit and fracture point.
c) Define bending moment at a section in a beam.
d) State and explain perpendicular axis theorem.
e) What is the difference between polar modulus and section modulus of any section?
f) What are the assumptions made in the theory of simple bending?
g) Explain the term 'torsional rigidity' and its significance.
h) With the help of a neat sketch show the shear stress distribution over a section of a circular shaft subjected to torsion.

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

a) A copper bar having its diameter 50mm for a length of 200mm and 20mm for a length of 150mm is subjected to axial tensile load of 12KN. Determine the stresses developed at section of diameter 50mm, section of diameter 20mm. Also determine total elongation developed in bar. Take E=100GPa.
b) A steel bar having a cross sectional area of 1200mm^2 is subjected to axial forces as shown in fig.1. Find the total elongation of the bar. Take E= 2 x 10^{5}Mpa
c) A cylindrical rod of diameter 20mm and length 500mm is subjected to a tensile force of 50KN along its axis. The material of the rod has a Poisson's ratio of 0.3 and a Young's modulus of 200GPa. Determine:
i)The lateral strain experienced by the rod
ii)If the linear strain is 0.00025, calculate the change in diameter of the rod due to applied force

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

a) A cantilever beam of length 4m carries point loads of 12KN at the free end and 17KN at 1m from the free end. Draw the SFD and BMD.
b) A simply supported beam of 12m span carries point loads of 15KN, 24KN and 19KN at distances of 3m, 5m and 8m from the left support. Draw the SFD and BMD.
c) A cantilever of 6m span carries a udl of 22KN/m over a length of 3m from the free end and a point load of 18KN at the free end. Draw the SFD and BMD.

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

a) Determine the moment of inertia of a triangular section with base 60mm and height 55mm about its centroidal axis.
b) Determine the moment of inertia of the 'T' section shown in fig.2. about X-X centroidal axis. What will be the change in this moment of inertia if this 'T' is inverted?

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c) Determine the moment of inertia of the 'I' section shown in fig.3. about X-X and Y-Y centroidal axis.

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

a) Write the bending equation and define all terms involved.

b) A mild steel flat 180mm in width and 16mm in thickness is bent to a circular arc of 9m radius. Determine the maximum bending moment and maximum bending stress in the section of the flat.

c) A hollow rectangular section beam is simply supported over 8m and carries a udl of 1500N/m. What will the maximum bending moment acting on this beam and what will the maximum bending stress in the section of the beam. Fig.4. shows the section of the beam.

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

a) A solid shaft of 40mm diameter is subjected to a torque of 800N-m. Determine the maximum shear stress developed in the shaft. Also draw shear stress distribution diagram.

b) A hollow shaft of 85mm outer diameter and 65mm inner diameter runs at 240rpm. Determine the power transmitted if the allowable shear stress is 60MPa.

c) A hollow circular shaft of outer diameter 80mm and inner diameter 50mm transmits 50KW of power at 300rpm. The material has a modulus of rigidity of 90GPa and the shaft is 2m:
i)Determine maximum shear stress induced in the shaft
ii)Calculate the angle of twist in degrees over the 2m length of the shaft

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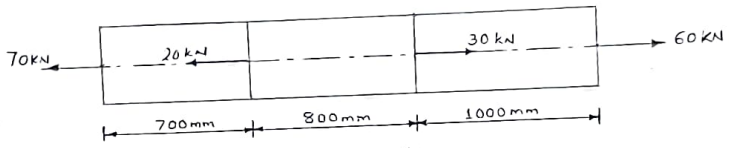

Fig 1, Q No 2(b)

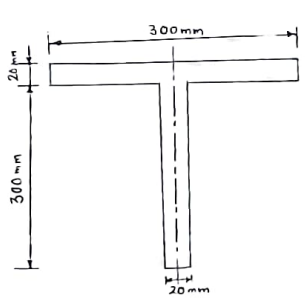

Fig 2, Q No 4(b)

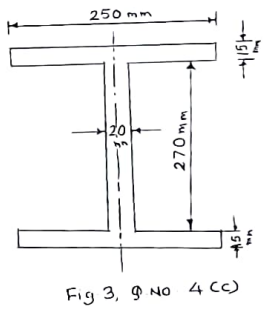

Fig 3, Q No 4(c)

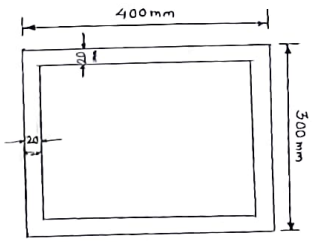

Fig 4, Q No 5(c)

x x x x x x

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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3 x 4 = 12

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

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 $x=1+\cos(2t)$, $y=1-\sin(3t)$

3 x 4 = 12

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

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-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

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 =

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

Programmed: **Mechanical Engg.**

Subject: **Solar PV Systems-I(CC504)**

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 are the two types of solar technologies generally used?
b) Differentiate between monocrystalline and polycrystalline solar panels.
c) Explain the purpose of a shadow frame area calculation in PV system design.
d) What is the main function of an inverter in a solar PV system?
e) List two types of batteries used in PV system.
f) Briefly described the concept of Building Integrated PV system(BIPV)
g) Name two components of an on-grid solar plant.
h) Mention one key step in the final commissioning checks of PV system.

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

a) Describe the working principle of P-N junction diodes and solar cells.
b) Explain the characteristics, merits and demerits of thin –film and flexible PV panels.
c) Discuss the various applications of solar technologies, including PV thermal systems.

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

a) Differentiate between on-grid, off-grid and hybrid solar plants.
b) Describe the operating principle of bificial solar panels and discuss a case study of their large scale installation.
c) Explain the main components of PV system and their functions.

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

a) Explain the basic principles for designing an on-grid PV system.
b) Describe the process of conducting a basic site feasibility study for a roof top PV system.
c) Discuss the environmental impact and sustainability of PV systems.

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

a) Elaborate on the installation procedure for a PV system, including structure mounting, panel mounting and final commissioning checks.
b) What are the different types of batteries used in PV systems? Explain their merits and demerits.
c) Explain the procedures for trouble shooting a PV system with simulated faults such as module failure or inverter errors.

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

a) TOPCON PV panels
b) Panel cleaning procedures
c) Schedules of solar PV plant maintenance
d) Market trends and future prospects of solar plants
e) Emerging photovoltaic materials

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BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

November, 2025 Examinations

Programme: **Mechanical Engg.**

Subject: **Refrigeration & Air Conditioning (MC621)**

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 COP. What is its unit?
b) State any three important properties of the refrigerant R600.
c) Compare air cooled condensers to water cooled condensers.
d) Why is the bulb of a wet bulb thermometer covered by a wet cloth?
e) List the factors affecting human comfort.
f) Define: i) Draft ii) Throw iii) Drop
g) List any three desirable properties of a refrigerant.

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

a) Fiving neat sketch explain the simple vapour compression system.
b) Give any six points of differences between a vapour compression cycle and a vapour absorption cycle.
c) Compare R600 to R134-a.

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

a) Explain with sketch the construction and working of a flooded evaporator.
b) Explain the working principle and applications of a capillary tube.
c) List and explain the factors to be considered while selecting supply air outlets.

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

a) Draw a neat sketch of psychrometric chart and explain its features.
b) Represent the following processes on psychrometric chart and highlight their salient features:
i)Humidification ii) Cooling and dehumidification
c) Derive expressions for enthalpy and humidity for two air streams mixing adiabatically.

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

a) Draw a neat schematic sketch of a centralized air conditioning system and list its features.
b) Explain the construction and working of an extended plenum duct system.
c) List the principles of air distribution system.

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

a) Applications of refrigeration
b) Screw compressor
c) Refrigeration methods
d) Thermostatic expansion valve

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BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

November, 2025 Examinations

Programme: **Mechanical Engg.**

Subject: **Maintenance Engineering (MC630)**

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 any three advantages of preventive maintenance.
b) Why is it advisable to maintain history cards of maintenance work carried out?
c) Describe in brief maintenance stores control.
d) How is maintenance inventory classified?
e) What are the benefits of vibration signature analysis of a machine?
f) Under what conditions solid lubricants are preferred.
g) Describe in brief method of reconditioning a key way.

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

a) What is maintenance manual? What are the benefits of having maintenance manual?
b) Discuss the merits and demerits of breakdown maintenance.
c) How are maintenance estimates prepared?

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

a) Explain the following terms with respect to predictive maintenance: i)Detection ii) Analysis iii) Correction
b) Explain various terms related to vibration monitoring.
c) Describe the following instruments used in vibration monitoring: i)Spike energy meter ii) Stroboscope

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

a) Name and explain various modes of lubrication.
b) Explain following systems of lubrication giving neat sketches: i)Cup type ii) Wick type
c) Describe the procedure for reconditioning and repair of following components: i)Flat surfaces ii) Gears

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

a) What is metal spraying? How is it useful in reconditioning of machine components?
b) Describe the servicing procedure of hydraulic and pneumatic valves.
c) Describe the procedure of pulling out and installing RC bearings.

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

a) Importance of preventive maintenance
b) Reference standards and charts used in defining levels of vibration
c) Types of lubricants
d) Belt tension adjustment

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BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

November, 2025 Examinations

Programme: **Mechanical Engg**

Subject: **Power Plant Engineering (MC623)**

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 down the advantages and disadvantages of a pulverised coal handling system.
b) With respect to air pollution explain a cyclone burner.
c) What is a closed cycle gas turbine power plant? List down its advantages and disadvantages.
d) Explain in brief the layout of a medium capacity diesel electric power plant.
e) Explain in brief the classification of various reactors.
f) What are the desirable properties of a nuclear fuel and moderator?
g) Explain the following: i)Connected load ii)Max demand iii)Demand factor

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

a) Discuss the various factors affecting the site selection of a hydro electric power plant.
b) Discuss the working of a storage type hydro electric power plant with a neat sketch.
c) What are the advantages and disadvantages of hydro electric power point?

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

a) With a neat sketch explain the working of a coal based steam power plant.
b) Discuss the working of regenerative type Rankine cycle with one bled.
c) Explain the working of a bin pulverised coal handling system.

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

a) Explain the working of a flash type system of boiler blow down.
b) Discuss the working of a tray type deaerator.
c) Explain the regenerative type of open cycle gas turbine power plant.

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

a) Discuss the working of a diesel electric power plant with a neat sketch.
b) Explain the following systems of a diesel electric power plant: i)Fuel storage and supply system ii)Air supply system iii)Exhaust system
c) Explain the working of a nuclear power plant with a neat sketch.

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

a) Discuss the working of a breeder reactor.
b) A power plant supplied the following loads to the consumers:

Time (hrs.)	0-6	6-8	8-12	12-14	14-18	18-22	22-24
Load (MW)	30	40	50	40	60	80	50

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BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

November, 2025 Examinations

Programme: **Mechanical Engg./A**

Subject: **Machine Drawing (MC301)**

Time Duration: **4 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 conventional representation for the following:
i)Roller bearing ii) Helical compression spring iii) Slotted head screw

b) Draw a neat sketch of a shaft with conventional break.

c) Draw the free hand sketch of a hexagonal nut in section.

d) Draw the double line representation for the following pipe fittings: i)Reducer ii) 90^0 elbow

e) Draw the appropriate symbols for the following welds:
i) Double V butt weld ii) Double J butt weld iii) Spot weld

f) Indicate the roughness grade symbol for the following roughness grade numbers:: i) N1 ii)N4 iii) N8

g) Draw the symbols for the following characteristics in geometrical tolerancing: i) Cylindricity ii) Parallelism
iii) Position

h) With the help of neat sketches, illustrate the following welded joints: i)Butt joints ii) Corner joint

Q.No.2. Answer the following Questions:

a) Draw the conventional representation for the following: **(05)**
i) Brass ii) Slate iii) Tin iv) Water v) Concrete

OR

a) With the help of suitable free hand sketches, show the following types of sections: i) Offset section ii) Revolved section **(05)**

b) Fig.1. shows the block diagram of a piping layout. Draw the same in single line. **(05)**

OR

b) Fig.2. shows the block diagram of a piping layout. Draw the same in double line. **(05)**

Q.No.3. Answer the following Question:

a) Draw neat proportionate free hand sketches of any two of the following: **2 x 5 = 10**
i)Flexible coupling
ii)Flat belt pulley with arms
iii)Socket and spigot pipe joint

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Q.No.4. Answer the following Question: (15)

a) Fig.3. shows the details of the protected type flange coupling. Draw to scale the following views of the assembly and show any ten dimensions: i)Front view with top half in section ii) Left side view

Q.No.5. Answer the following Question: (15)

a) Fig.4. shows the orthographic views of the plummer block. Draw to scale the following with dimensions:
i) Body –front view with left half in section ii) Cap-front view with left half in section , top view

Q.No.6. Answer any two of the following Questions: 2 x 5 = 1

a) Fig.5. shows the orthographic views of a machine part to be fabricated by welding. Redraw the views and indicate the following:
i)Piece 2 to be joined to piece 1 by fillet weld 6mm leg and single J butt weld ,flush finish by grinding
ii)Piece 3 to be joined to piece 1 by fillet weld 6mm leg and single V butt weld, included angle of groove 70^0, flush finish
iii)Piece 2 to be joined to piece 3 by fillet weld 6mm leg and single U butt weld, convex contour
iv) Piece 4 to be joined to piece 2 by all round fillet weld 5mm leg and at site .Gas welding to be used

b) Tolerances for a hole and a shaft to be assembled are as given below:
Hole: $35^{+0.039}_{0.000}$ Shaft: $35^{-0.080}_{-0.142}$
Calculate: i) Maximum and minimum limits of size
ii) Maximum and minimum allowances
Represent the fit graphically and name the type of fit.

c) Fig.6 shows the orthographic views of the sheave of an eccentric. Redraw the same and indicate the following:
i)Cylindrical surface of Ø200mm to be machined and roughness to be indicated by ∇∇
ii) Tolerance of H7 on Ø80mm
iii)Tolerance of e8 on Ø190mm
iv) Axis of hole Ø80mm to be straight within 0.01mm
v) Radial run out of the cylindrical surface of Ø200mm to be within 0.01mm

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BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

November, 2025 Examinations

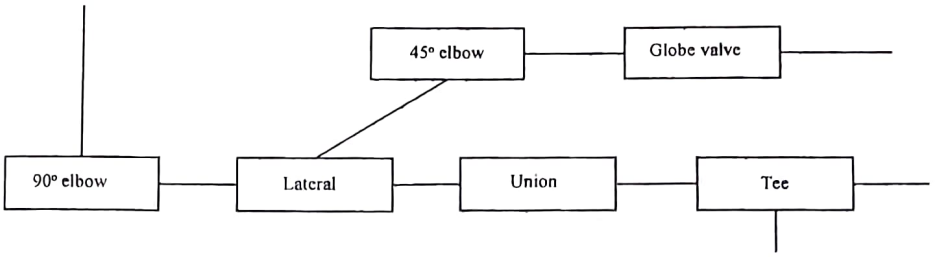


Fig. (1) [Q. No. 2(b)]

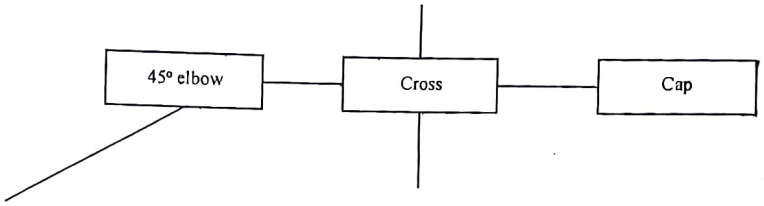
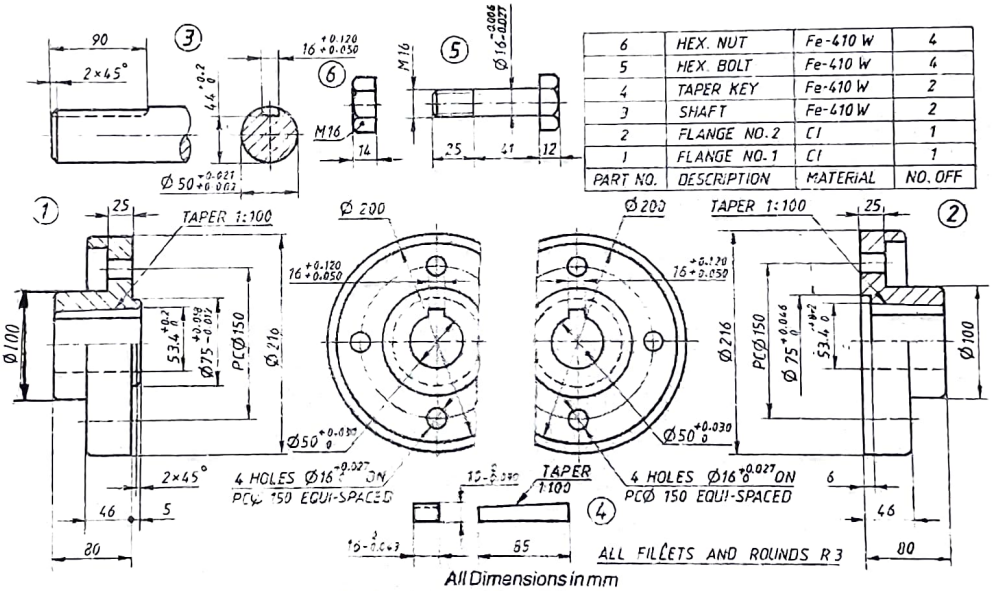


Fig. (2) [Q. No. 2(b)]



All Dimensions in mm

Details of Flanged Coupling — Protected Type

Fig. (3) [Q. No. 4a]

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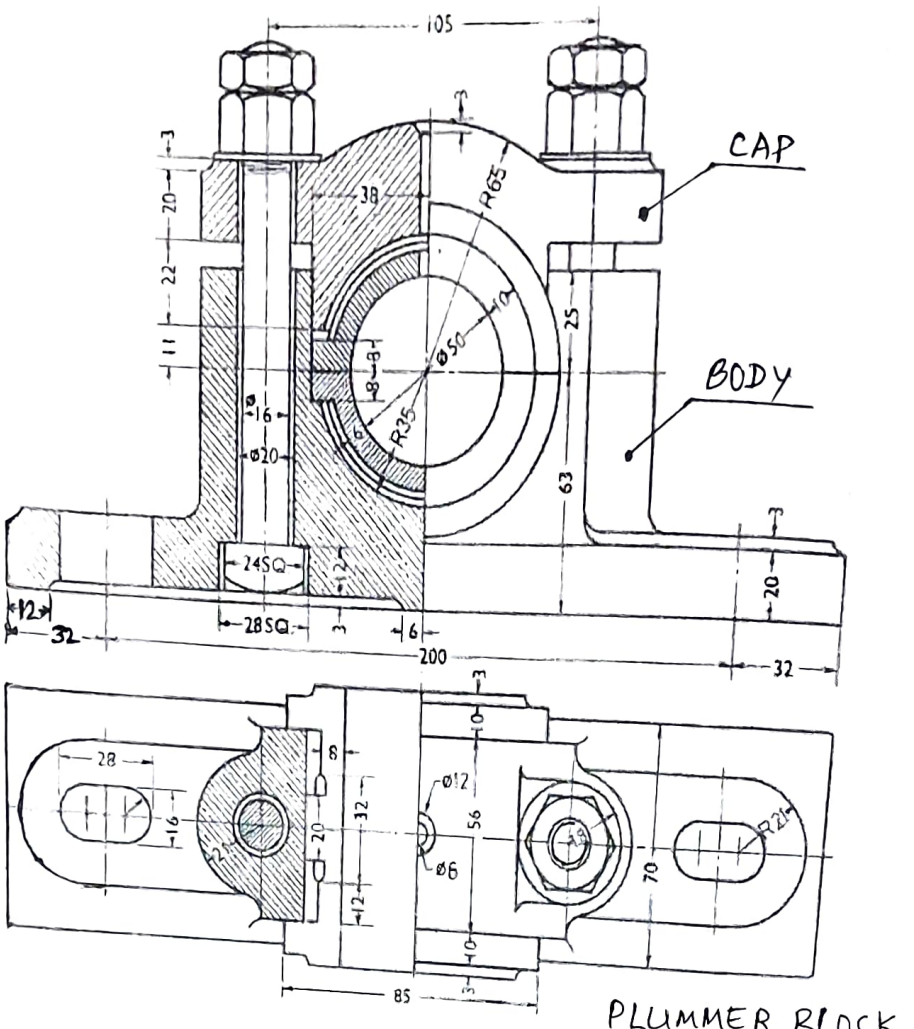

PLUMMER BLOCK

Fig. (4) [Q. No. 5a]

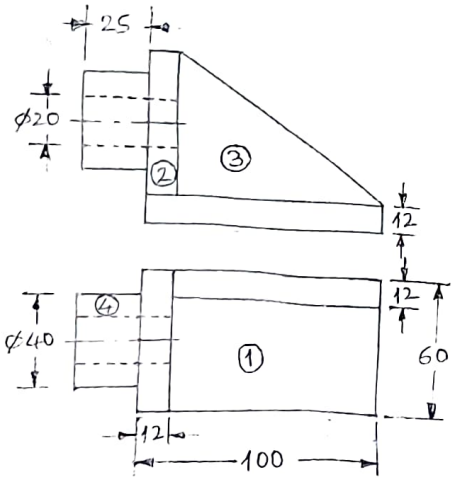

Fig. (5) [Q. No. 6(a)]

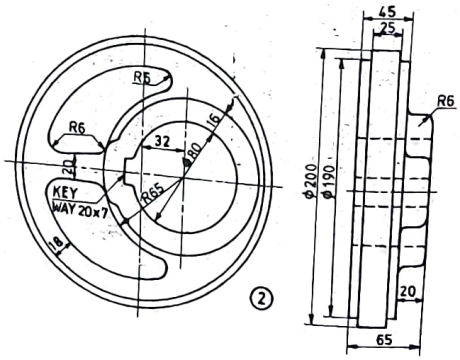

Fig. (6) [Q. No. 6(c)]

ALL DIMENSIONS ARE IN MM

BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

November, 2025 Examinations

Programme: **Mechanical Engg.**

Subject: **Metrology & Quality Control (MC406)**

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 the importance of precision and accuracy in Metrology.
b) List any three linear and angular instruments used in Metrology, arranged according to their accuracy levels.
c) What is the significance of gauge tolerance?
d) Explain any two types of errors in screw threads.
e) State any three characteristics of quality.
f) Define quality and state the role of management in Quality Control.
g) With the help of a neat sketch show the arrangement of mechanical comparator used for measurement.

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

a) Explain the different sources of errors in measurement.
b) Show the setup of a 200mm sine bar to 32° using minimum number of slip gauges. Use M112 set given below:

Range (mm)	Steps (mm)	No° of blocks
1.001 – 1.009	0.001	9
1.01 – 1.49	0.01	49
0.5 – 24.5	0.5	49
25 – 100	25	4
1.0005	-	1

c) With the help of a neat sketch, explain the working of an Autocollimator.

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

a) A hole is specified with a basic size of 40mm and a tolerance of +0.03m/ -0.010mm
i)Determine the maximum limit and minimum limit of the hole ii)Find the tolerance value iii)A shaft of size 39.98mm ±0.01mm is to be fitted in this hole. Calculate the maximum clearance and minimum clearance and state the type of fit.
b) Explain the types of fits. Represent each fit with a neat sketch.
c) With a neat sketch explain hole basis and shaft basis system.

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

a) List and compare the various types of comparators based on magnification, range, accuracy, cost and application.
b) Explain any two methods used for testing of roundness.
c) With the help of a neat sketch, describe how parameters of screw thread like major diameter, minor diameter and pitch are measured.

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

a) Define Quality Control and explain the principles of TQM.

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b) A factory produces ball bearings in lots of 200 items each. The number of defectives found in 10 successive lots is shown below:

Lot No.	1	2	3	4	5	6	7	8	9	10
Defectives	8	12	10	9	11	7	13	10	12	4

i)Identify the suitable chart and compute the control limits
ii)Comment whether the process is in statistical control

c) A manufacturing company monitors the diameter of a critical component using an $\overline{X}$ and R control chart over 25 consecutive samples, each consisting of 5 measurements. The company calculates the average and range of each sample

i)Explain the purpose of using $\overline{X}$ and R control charts in Quality Control
ii)How would you determine the control limits for both the charts? (only method or formulas)
iii)If the sample average falls outside the control limits, what action should the QC team take?
iv)Discuss at least two reasons which might lead to points falling outside the control limits

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

a) Write a short note on angle gauges.
b) Write a short note on six sigma concept.
c) Why is acceptance sampling typically used for large batches instead of inspecting every item individually?
d) Differentiate between single and double sampling plans.
e) Discuss the necessity of ISO implementation in industries.

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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=6.4×10^6m, 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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04/11/2025 2:00 to 5:00 pm

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, 2025 Examinations

Programme: **Mechanical Engg.**

Subject: **Theory of Machines (MC501)**

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 slip with reference to belt drive. Also list the commonly used belt materials.

b) What is the function of a fly wheel? How does it differ from that of governor?

c) Explain the following terms with examples:
i)Link ii) Kinematic pair

d) Define the terms 'stability' and 'isochronism' as used for governor.

e) Why is balancing required for rotors of high speed engines?

f) What is 'self locking' and 'self energizing' in brakes?

g) Draw the free hand sketch of a gear tooth profile of spur gear and show: i) Face ii) Addendum iii) Dedendum circle

h) List down various types of cams and followers. Draw a neat sketch of spherical cam.

i) Answer the following questions:
Match the following:

i) Double crank Mechanism	Oldham's Coupling
ii) Single slider crank chain	Coupled wheel of locomotive
iii) Double slider crank chain	Crank and slotted lever mechanism

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

a) List the different inversions of single slider crank chain and explain with neat sketch whit worth quick return mechanism.

b) Explain with neat sketch construction and applications of 'Geneva Mechanism'.

c) Explain with a neat sketch the construction and working principle of Watt Governor.

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d) Saybolt Viscom...

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Q.No.3. Answer the following Questions:

a) A cam with 30mm as minimum diameter is rotating clock-wise at a uniform speed of 1200r.p.m. and has to give the following motion to a roller follower 10mm in diameter: **(08)**

i)Follower to complete outward stroke of 25mm during 120° of cam rotation with equal uniform acceleration and retardation

ii)Follower to dwell for 60° of cam rotation

iii)Follower to return to its initial position during 90° of cam rotation with equal uniform acceleration and retardation

iv)Follower to dwell for the remaining 90° of cam rotation

Draw the cam profile if the axis of the roller-follower passes through the axis of cam. Determine the maximum velocity of the follower during the outstroke and return stroke.

OR

b) A cam rotating clockwise at uniform speed of 100r.p.m. operates a knife edge follower as defined below: **(08)**

i)Follower to move outwards through 25mm during 120° of cam rotation

ii)Follower to dwell for the next 60° of cam rotation

iii)Follower to return to its starting position during next 90° of cam rotation

iv)Follower to dwell for the rest of the cam rotation

The displacement of the follower takes place with uniform and equal acceleration and retardation on both the outward and return strokes. Draw the cam profile when the follower axis is offset to right by 10mm from the axis of the cam. Determine the maximum velocity and acceleration during outstroke and return stroke.

c) What is turning moment diagram? Draw turning moment diagram for single cylinder four stroke I.C. engine. (04)

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

a) Two parallel shafts 6m apart are to be connected by a belt running over pulleys of diameter 60cm and 40cm respectively. Determine the length of the belt required:
i)If the belt is open ii)If the belt is crossed

b) State the primary advantages and disadvantages of belt and chain drives. Also explain the term creep of belt.

c) A shaft running at 160rpm is to drive another shaft at 250rpm and transmit 20KW. The belt is 115mm wide and 12mm thick. The coefficient of friction between the belt and pulley is 0.25. The distance between the shaft is 2.75m. The smaller pulley is 0.6m in diameter. Determine the stress in the belt in case of open belt drive.

...3/-

Q.5. Answer any two of the following Questions: **2 x 6 = 12**

a) i) Sketch and label an epicyclic gear train. **(02)**

ii) In a compound gear train, the power is transmitted from a motor shaft to output shaft. The motor shaft is connected to gear '1' whereas the output shaft is connected to gear '6'. The motor shaft is rotating at 1125r.p.m. in the clockwise direction. Find the direction and speed of output shaft. The number of teeth on each gear is given as: (Refer fig. 1.) **(04)**

Gear	1	2	3	4	5	6
No. of teeth	30	75	40	120	28	70

b) Four masses 150, 250, 200 and 300Kg are rotating in the same plane at radii of 0.25, 0.2, 0.3 and 0.35m respectively. Their angular location is 40°, 120° and 250° from mass 150Kg respectively, measured in counter-clockwise direction. Find the position and magnitude of the balance mass required if its radius of rotation is 0.25m.

c) Drive an expression for velocity ratio of a compound gear train.

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

a) A simple band brake is applied to a rotating drum of diameter 500mm. The angle of lap of the band on the drum is 270°. One end of the band is attached to a fulcrum pin of the lever and the other end to a pin 100mm from the fulcrum. If the coefficient of friction is 0.25 and a braking force of 90N is applied at a distance of 600mm from the fulcrum, find the braking torque when the drum rotates in anti-clock wise direction.(Refer fig.2.)

b) With a neat sketch explain internal expanding shoe brake

c) What are two types of absorption dynamometers? Explain with a neat sketch proxy brake dynamometer.

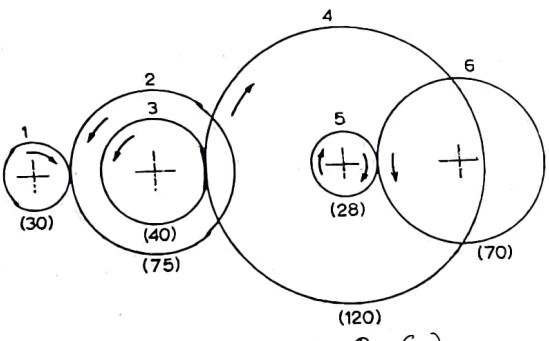

Fig.1 Q5(a)

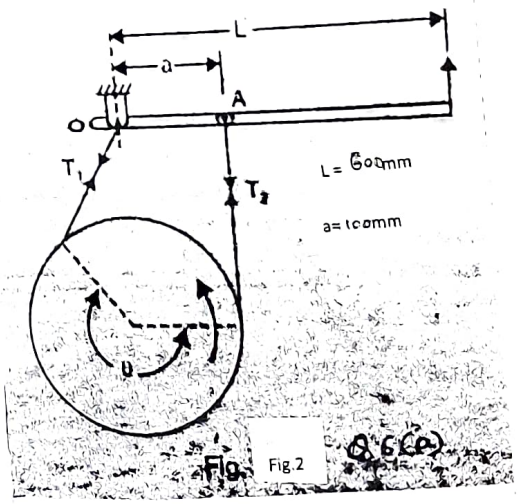

Fig. Fig.2 Q6(a)

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BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

November, 2025 Examinations

Programme: **Mechanical Engg.**

Subject: **Production Management(MC603)**

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 various internal factors affecting productivity.
b) Draw the various method study symbols used to record events in flow charts with meaning and example.
c) Explain briefly the concept of work study.
d) State the objectives of plant layout.
e) What do you understand by? i)Plant capacity ii)Machine capacity
f) Differentiate between job production and continuous production with respect to: i)Product design ii)Type of plant layout iii)Prior planning and control
g) Explain briefly the need for sales forecasting.

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

a) Explain the difference between production and productivity with the help of an example.
b) What is the difference between partial and total productivity? Write down two advantages and two limitations of partial productivity.
c) Explain in brief the work study procedure.

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

a) Explain 'installing and maintaining' of new method in method study.
b) Write a short note on 'micromotion study'.
c) The observed times and ratings for the four elements of a job are given below. Calculate the standard time of the job.

Element	Observed time(minutes)	Rating	Allowance
A	0.25	80	10%
B	0.09	100	11%
C	2.8	90	12%
D	0.05	80	10%

The allowances are percentages of basic time.

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

a) Explain the factors influencing plant layout.
b) Differentiate between product and process layout.
c) Write a note on 'batch production' with an example.

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

a) Define production planning and control. Write down any five objectives of production planning and control.
b) Explain the relationship between process and machine selection.
c) Write a note on 'Six Sigma'.

...2/-

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

a) Briefly explain how you forecast demand for a new product?

b) The demand for a product is given below:

Month	April 2024	May 2024	June 2024
Demand	200	50	150

Determine the forecast for July 2024 taking the value of smoothing constant as 0.2.

c) Explain briefly the opinion survey' method of sale forecasting.

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BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

November, 2025 Examinations

Programme: **Engineering & Technology**

Subject: **Engineering Mechanics (CC301)**

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 force. What are the characteristics of force for complete specification?
b) Define moment. What are the conditions for zero moment?
c) State and explain Lami's theorem with an example.
d) Define centroid. Locate centroid of semicircle and right angled triangle.
e) Explain the concept of Equilibrium.
f) State and explain law of machine.
g) Define momentum, impulse and impulsive force.

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

a) Find the resultant in magnitude and direction of the concurrent force system. (Refer fig.1.)
b) Find the resultant in magnitude and direction and find its position from A of the non-concurrent force system.(Refer fig.2.)
c) Find the resultant in magnitude, direction and position of the parallel force system.(Refer fig.3.)

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

a) A weight 4000N is suspended at point B. Find the forces in AB and BC using Lami's theorem.(Refer fig.4.)
b) A simply supported beam of span 12m is subjected to 5KN and 6KN at 4m from either support and uniformly distributed load 2KNm in between the two points loads. Find the reaction at the supports.(Refer fig.5.)
c) A beam of span 10m is hinged at A and has roller support at B. It is loaded as shown in figure. Find the reaction at A and B.(Refer fig.6.)

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

a) A block of weight 40KN rests in limiting equilibrium on a rough plane whose slope is 30^0. The plane is raised to a slope of 60^0. What force applied to the body parallel to the inclined plane will support the body on the plane?
b) A block lying on a horizontal plane is moved slowly along the plane when horizontal force 100N is applied to the body. Also a force of 90N is applied to the body at an angle of 30^0 to the horizontal moves the body slowly along the same plane. Determine the weight of the body and coefficient of the friction.
c) Find the centroid of the 'T' section.(Refer fig.7.)

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

a) A vehicle of mass 2000Kg has a velocity of 40kmph. On its way it hits a car parked by the road side. In doing so its velocity is reduced to 30kmph. Find the momentum absorbed by the car if the mass of the car is 250Kg. Find its velocity.

...2/-

b) Two blocks of masses 25Kg and 15Kg connected with a string. The 25Kg mass is placed on horizontal plane with coefficient of friction 0.25. The 15Kg mass is suspended freely at the end of string passing over smooth pulley. Find the tension in the string and the acceleration of the system.

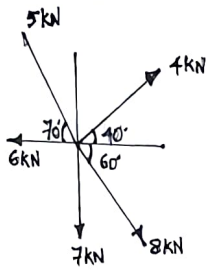
c) A lift has an upward acceleration of 1.5m/sec^2. Find the pressure exerted by a man of mass 65Kg on the floor of the lift. When the lift is lowered downward with the acceleration of 1.5m/sec^2, find the pressure exerted by the man on the floor of the lift.

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

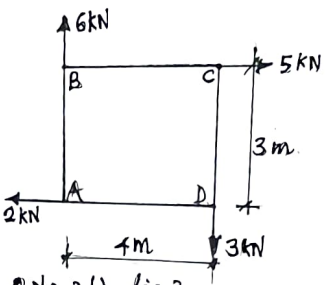
a) Find the centre of gravity of the composite solid with hemisphere attached to cylinder as shown in fig.8.

b) In a lifting machine a load of 1000N is moved through a distance of 5cm. by an effort P moving through a distance of 80cm. Find the value of P if the efficiency of the machine is 60%.

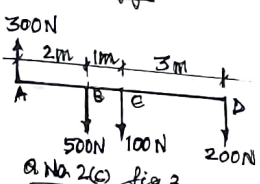
c) A single purchase crab has diameter of the load drum d=0.2m and diameter of effort wheel is 2.4m. Number of teeth on the pinion is T_1= 10 and number of teeth on spur wheel is T_2=100. Find the velocity ratio. If 10N effort is required to lift a load of 300N, find the efficiency of the machine.



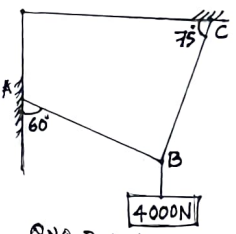
Q.No. 2(a) fig 1



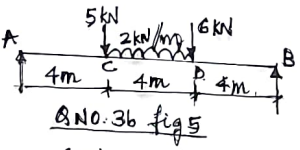
Q. No. 2b) fig 2.



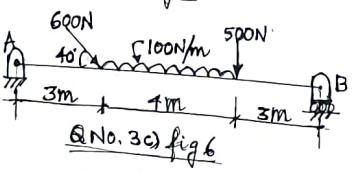
Q No. 2(c) fig 3



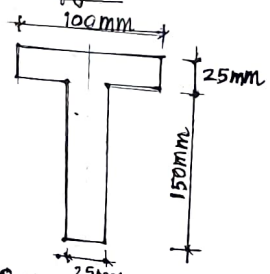
Q NO. 3 a) fig 4



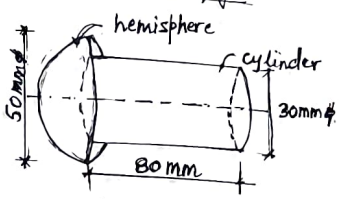
Q NO. 3b fig 5



Q No. 3c) fig 6



Q. No. 4 c) fig 7



Q NO: 6a) fig 8

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