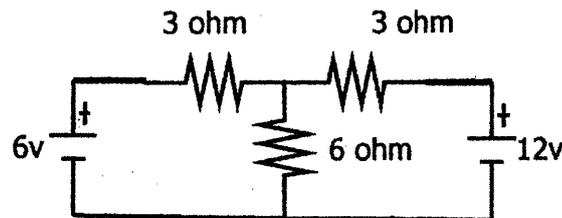


Exam.	Regular		
Level	BE	Full Marks	80
Programme	All (Except B.Arch.)	Pass Marks	32
Year / Part	I / II	Time	3 hrs.

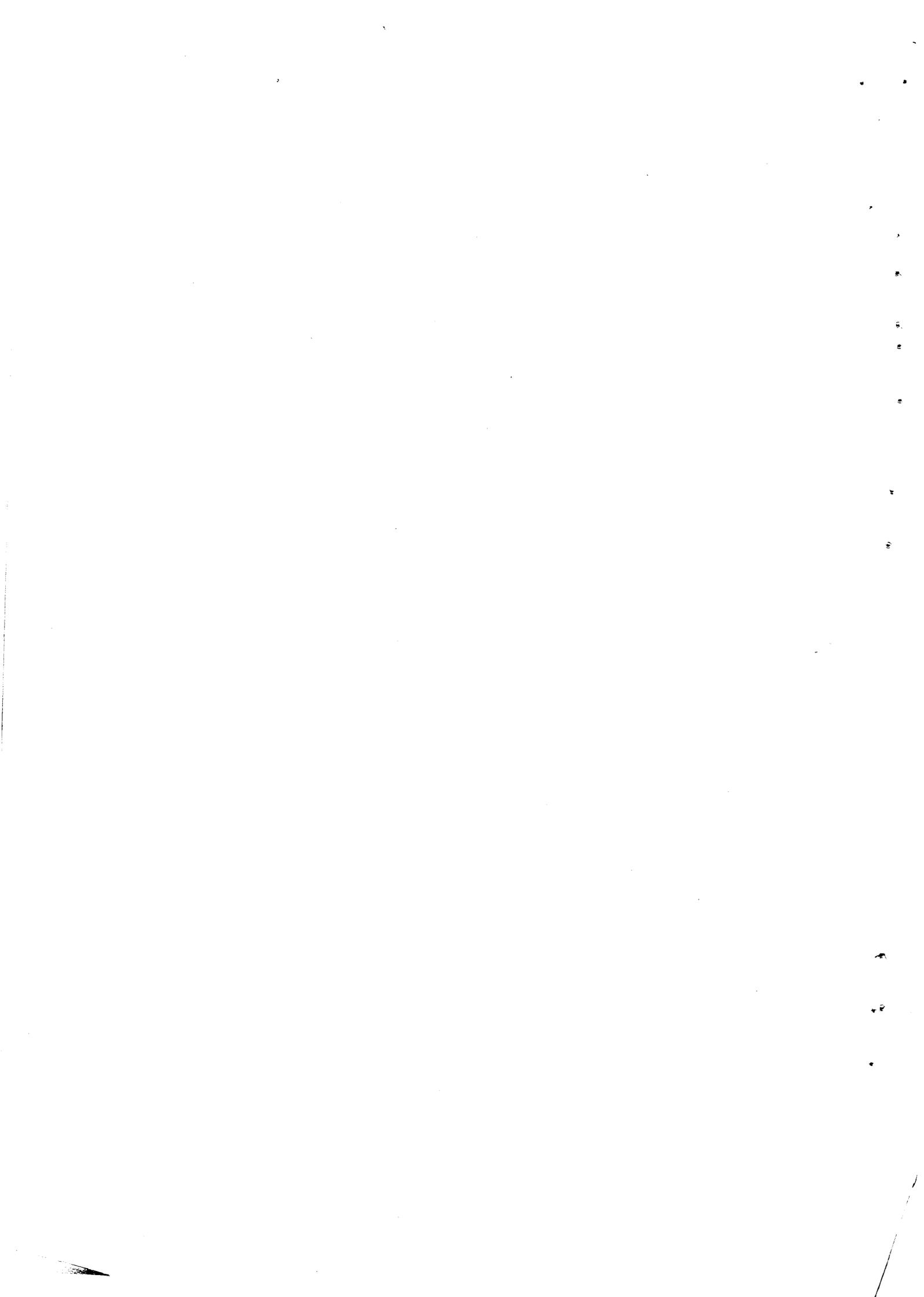
Subject: - Basic Electronics Engineering (EX451)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt **All** questions.
- ✓ The figures in the margin indicate **Full Marks**.
- ✓ Assume suitable data if necessary.

1. Describe different types of controlled source with figures. [4]
2. Calculate the current flowing in each branch using superposition theorem. [6]



3. Describe the rectification process. Explain the operation of half wave rectifier with necessary diagrams. [1+4]
4. What is diode clamper? Describe the operation diode clamper circuit. [1+4]
5. Draw the DC load line and determine the Q point of the voltage divider biased transistor circuit having $V_{cc} = 15v$, $R_c = 1k\Omega$, $R_1 = 10 k\Omega$, $R_2 = 5k\Omega$, $R_e = 2k\Omega$ and $\beta = 75$. [6]
6. Why BJT is a bipolar and MOSFET is an unipolar device? And draw the circuit diagram of differential amplifier using BJT. [2+2]
7. Explain the operation of CMOS switch with necessary diagrams. [4]
8. Mention any four properties of an ideal OP amp. Derive the expression of voltage gain of an inverting amplifier using OP amp. [2+4]
9. Draw a circuit diagram of square wave generator using OP amp. Explain how it generates the square wave. Express the frequency of the square wave generated. [2+3+1]
10. What is Optical fiber? Explain the advantages of optical fiber communication over coaxial cable communication. [1+3]
11. Define communication system. And describe communication system in brief with the complete block diagram. [2+3]
12. Simplify the expression using K-Map, $F(x,y,z) = X'YZ + X'Y'Z + XYZ$ and realize it using logic gates. [5]
13. Mention the types of flip flops and explain the operation of J-K flip flop with necessary diagrams. [1+4]
14. Draw a block diagram of digital multimeter. Explain how it measures dc current flowing through it. [5]
15. Draw and explain the block diagram of data logger. [4]
16. Write short notes on: (any two) [2×3]
 - a) Light emitting diode
 - b) Output characteristics of common base configuration
 - c) Regulated power supply



Exam-	Regular		
Level	BE	Full Marks	80
Programme	All (Except B.Arch.)	Pass Marks	32
Year / Part	I / II	Time	3 hrs.

Subject: - Engineering Mathematics II (SH451)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ All questions carry equal marks.
- ✓ Assume suitable data if necessary.

1. State Euler's Theorem for a homogeneous function of two independent variables and verify it for the function $u = x^n \tan^{-1}\left(\frac{y}{x}\right)$
2. Find the extreme value of $x^2 + y^2 + z^2$ connected by the relation $ax + by + cz = p$.
3. Evaluate $\iint xy(x+y) dx dy$ over the area between $y = x^2$ and $y = x$.
4. Evaluate the integral by changing to polar coordinates $\int_0^a \int_0^{\sqrt{a^2-x^2}} y^2 \sqrt{x^2 + y^2} dy dx$

OR

Find by triple integration the volume of the sphere $x^2 + y^2 + z^2 = a^2$.

5. Find the equation of the plane through the line $2x + 3y - 5z = 4$ and $3x - 4y + 5z = 6$ and parallel to the coordinate axes.
6. Find the length and equation of shortest distance between the lines $\frac{x-3}{3} = \frac{y-8}{-1} = \frac{z-3}{1}$ and $2x - 3y + 27 = 0, 2y - z + 20 = 0$.
7. Obtain the centre and radius of the circle $x^2 + y^2 + z^2 + x + y + z = 4, x + y + z = 0$.
8. The plane through OX and OY includes an angle α , prove that their line of intersection lies on the cone $z^2(x^2 + y^2 + z^2) = x^2 y^2 \tan^2 \alpha$

OR

Find the equation of the right circular cylinder of radius 2 whose axis is the line

$$\frac{x-1}{1} = \frac{y-2}{1} = \frac{z-3}{2}$$

9. Solve by power series method the differential equation $y'' - 4xy' + (4x^2 - 2)y = 0$.
10. Express $f(x) = x^3 - 5x^2 + x + 2$ in terms of Legendre's polynomial.
11. Show that $J_{-\left(\frac{5}{2}\right)}(x) = \sqrt{\frac{2}{\pi x}} \left(\frac{3}{x} \sin x + \frac{3-x^2}{x^2} \cos x \right)$.

12. Prove that $\left[\begin{matrix} \vec{b} \times \vec{c} & \vec{c} \times \vec{a} & \vec{a} \times \vec{b} \end{matrix} \right] = \left[\begin{matrix} \vec{a} & \vec{b} & \vec{c} \end{matrix} \right]^2$

13. A particle moves along the curve $x = a \cos t$, $y = a \sin t$ and $z = bt$. Find the velocity and acceleration at $t = 0$ and $t = \pi/2$.

14. Find the directional derivative of $\phi(x, y, z) = xy^2 + yz^3$ at the point $(2, -1, 1)$ in the direction of vector $\vec{i} + 2\vec{j} + 2\vec{k}$.

OR

If \vec{a} is a constant vector and \vec{r} be the position vector then prove that $(\vec{a} \times \nabla) \times \vec{r} = -2\vec{a}$.

15. Test the convergence of the series

$$\frac{x}{1.2} + \frac{x^2}{2.3} + \frac{x^3}{3.4} + \dots, x > 0$$

16. Find the interval and radius of convergence of the power series $\sum_{n=1}^{\infty} \frac{(-3)^n x^n}{\sqrt{n+1}}$.

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT, BIE, B.Agri., BAME	Pass Marks	32
Year / Part	I / II	Time	3 hrs.

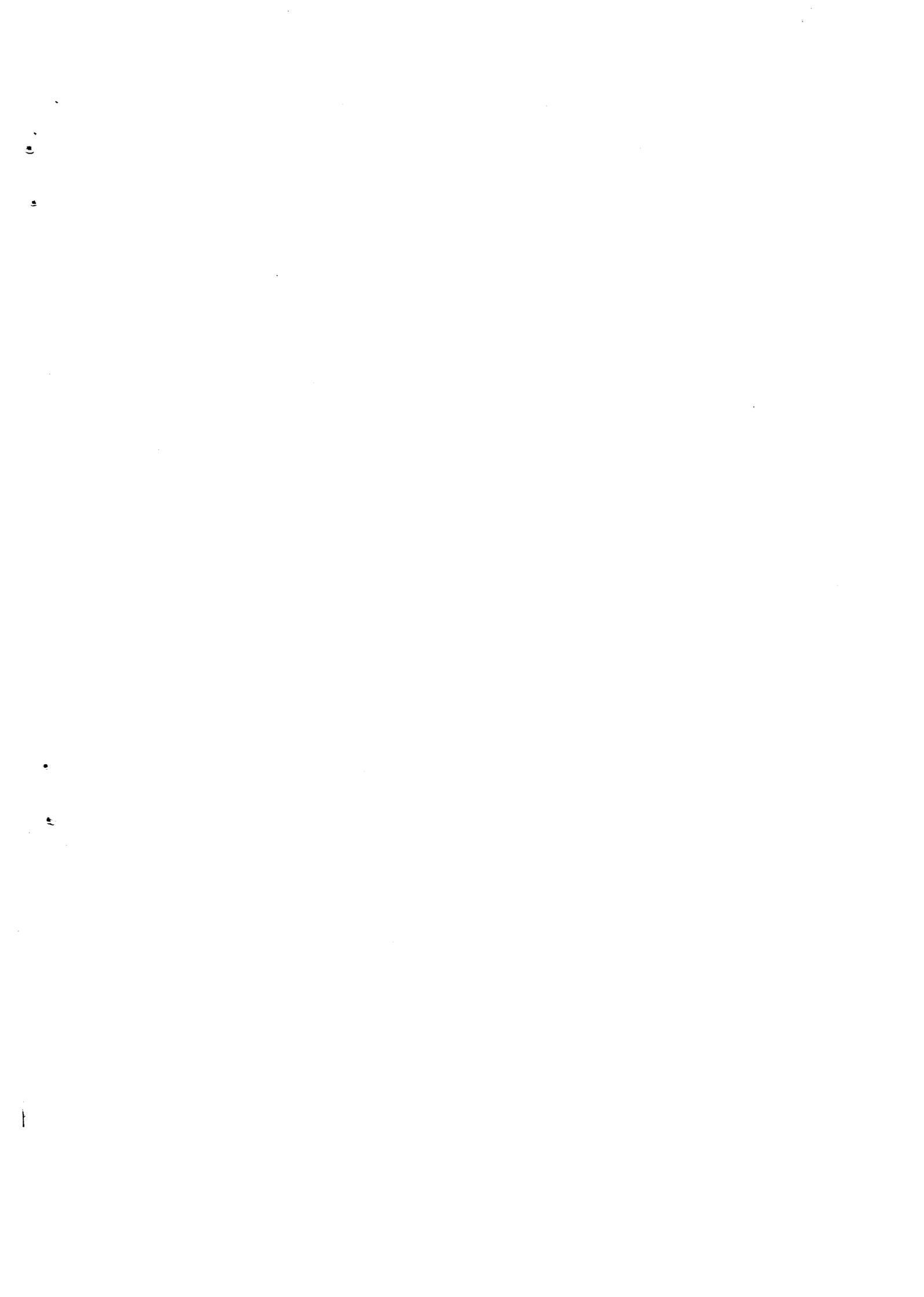
Subject: - Engineering Chemistry (SH453)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Define electrode potential. How do you measure standard electrode potential of zinc electrode? Find the Emf of the following cell at 25°C. [1+2+2]
 $\text{Cu}/\text{Cu}^{++}(0.2\text{M})//\text{Ag}^+(0.1\text{M})/\text{Ag}$
 Given: $E^\circ\text{Ag}^+/\text{Ag} = 0.80\text{V}$ and $E^\circ\text{Cu}/\text{Cu}^{++} = -0.34\text{V}$
2. What are the criteria for buffer system? Calculate the weight in gram of NH_4Cl required to prepare buffer solution with 2 litre of 0.2N NH_4OH solution with $\text{pH} = 9$. ($K_b = 1.8 \times 10^{-5}$) [2+3]
3. How does a catalyst increase the speed of a reaction? Explain heterogeneous catalysis. Explain with an example the adsorption theory of catalysis. [1+1+3]
4. What are water pollutants? Write the major sources of water pollution. How do the oxides of sulphur and nitrogen make water acidic? [1+2+2]
5. Write notes on: [2.5+2.5]
 - a) Acid rain
 - b) Ozone depletion
6. What is paint? What are the requisites of good paint? Show your familiarity with the types of paints. [1+2+2]
7. a) Write the preparation and uses of polyphosphonitrilic chloride. [2.5]
 b) Write the types of silicones and their uses. [2.5]
8. Write short notes on Bakelite and Teflon. [2.5+2.5]
9. Write the important characteristics of explosives? Give the preparation and uses of TNT? Why does detonator required for the explosion of TNT? [2+2+1]
10. What are transition elements? Write the electronic configurations of the 1st row transition series. The paramagnetism of substance is due to the presence of unpaired electrons. Explain. [1+2+2]
11. Give the reasons for the features of the transition metals.
 - a) Most of the transition metal ions are colored in solution.
 - b) Transition metals are well known to form complex compounds. [2.5+2.5]
12. a) Differentiate between complex compounds and double salts. [1]
 b) Write the IUPAC name of the following complexes compounds and find the Effective Atomic Number of the central metal in these complexes. [4]
 - (i) $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$
 - (ii) $[\text{Cr}(\text{H}_2\text{O})_4\text{Cl}_2]\text{Cl}$
 - (iii) $[\text{Cu}(\text{NH}_3)_4]\text{SO}_4$
 - (iv) $\text{K}_3[\text{AlF}_6]$



13. Using VBT, explain as to show the two complexes $[\text{Ni}(\text{CN})_4]^{2-}$ and $[\text{Ni}(\text{Co})_4]$ have different structure but do not differ in their magnetic behavior. [5]
14. a) Write Cis, Trans and Z, E notation for the possible isomer of but-2-enedioic acid.
b) Distinguish between enantiomers and diastereoisomers. Give an example to support your answer. [2+3]
15. Write the mechanism of the reaction of tertiary alkyl halide with
a) Aqueous NaOH
b) Alcoholic KOH [2.5+2.5]
16. a) How does the reaction of bromomethane occur with aqueous caustic soda?
b) Explain the reaction mechanism of dehydrohalogenation of 1° alkyl halide. [2.5+2.5]

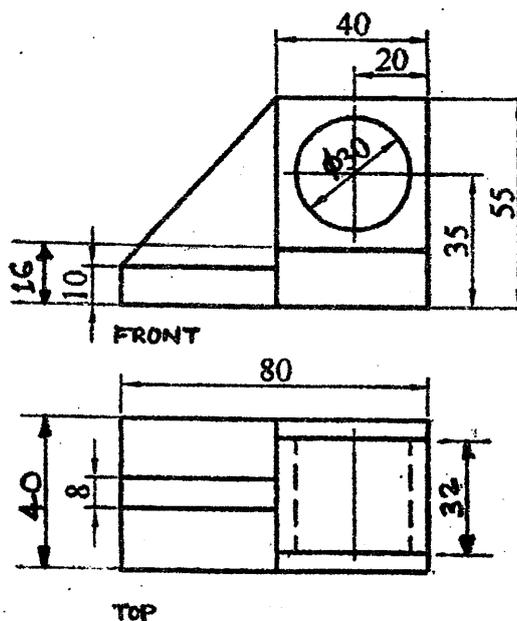


Exam.	Regular		
Level	BE	Full Marks	40
Programme	All (Except B.Arch.)	Pass Marks	16
Year / Part	I / II	Time	3 hrs.

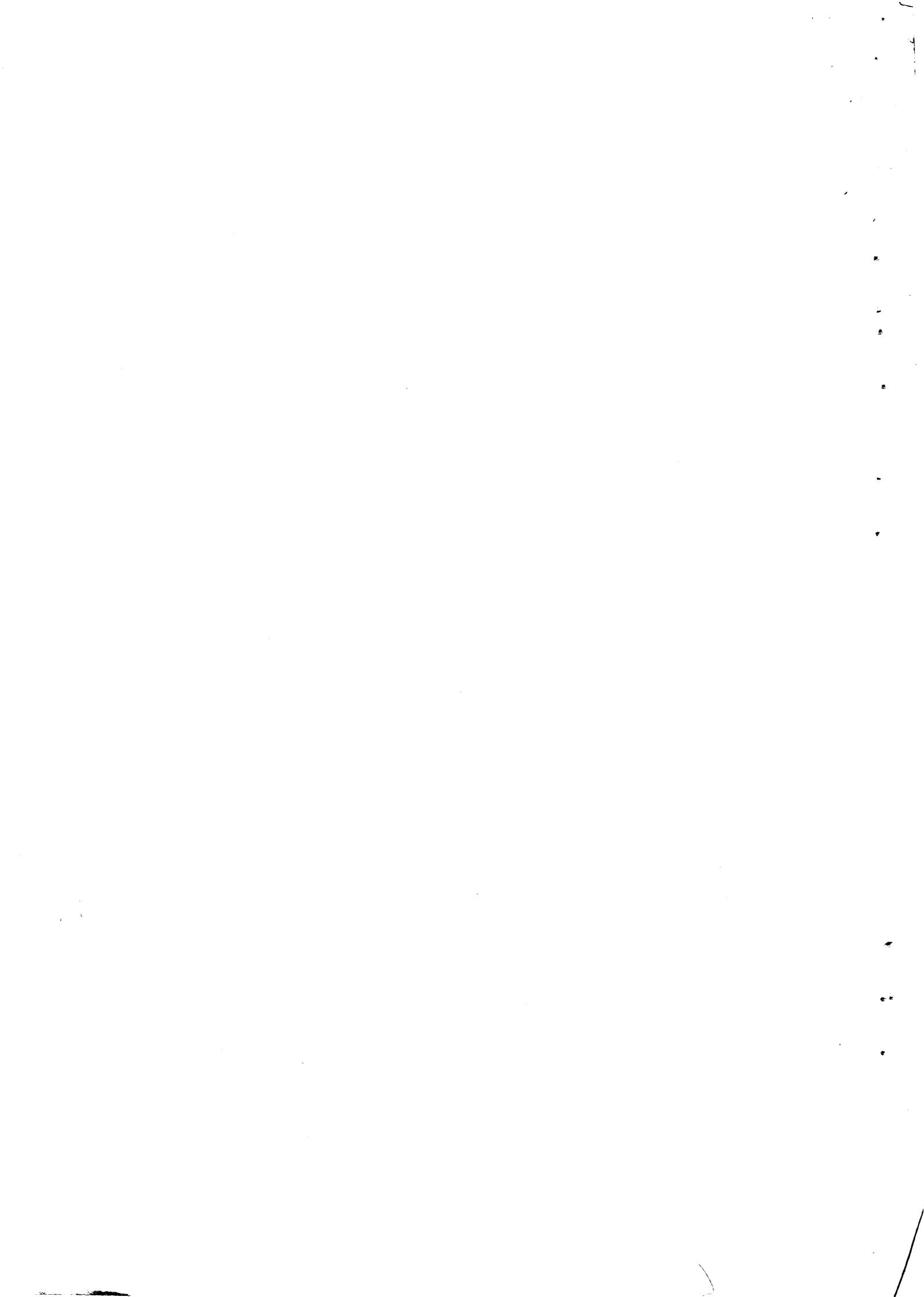
Subject: - Engineering Drawing II (ME451)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Orthographic views of an object is shown in figure below. Draw its isometric view. [10]



2. A right regular square pyramid, base edge 30 mm and altitude 40 mm rests with its base on the ground and the base edges are equally inclined to the picture plane. The nearest front corner of the base is 10 mm behind the PP. The station point is 45 mm in front of the PP, 60 mm above the ground and lies in the central plane which passes through the vertex of the pyramid. Draw the perspective view of the pyramid. [6]



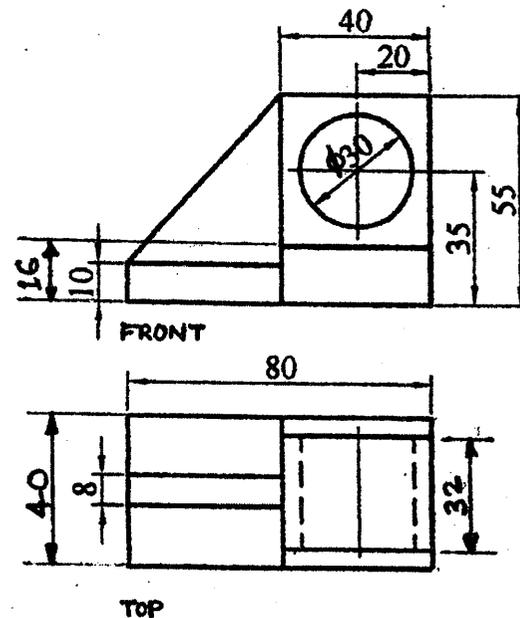
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 INSTITUTE OF ENGINEERING
Examination Control Division
 2073 Bhadra

Exam.	Regular		
Level	BE	Full Marks	40
Programme	All (Except B.Arch.)	Pass Marks	16
Year / Part	I / II	Time	3 hrs.

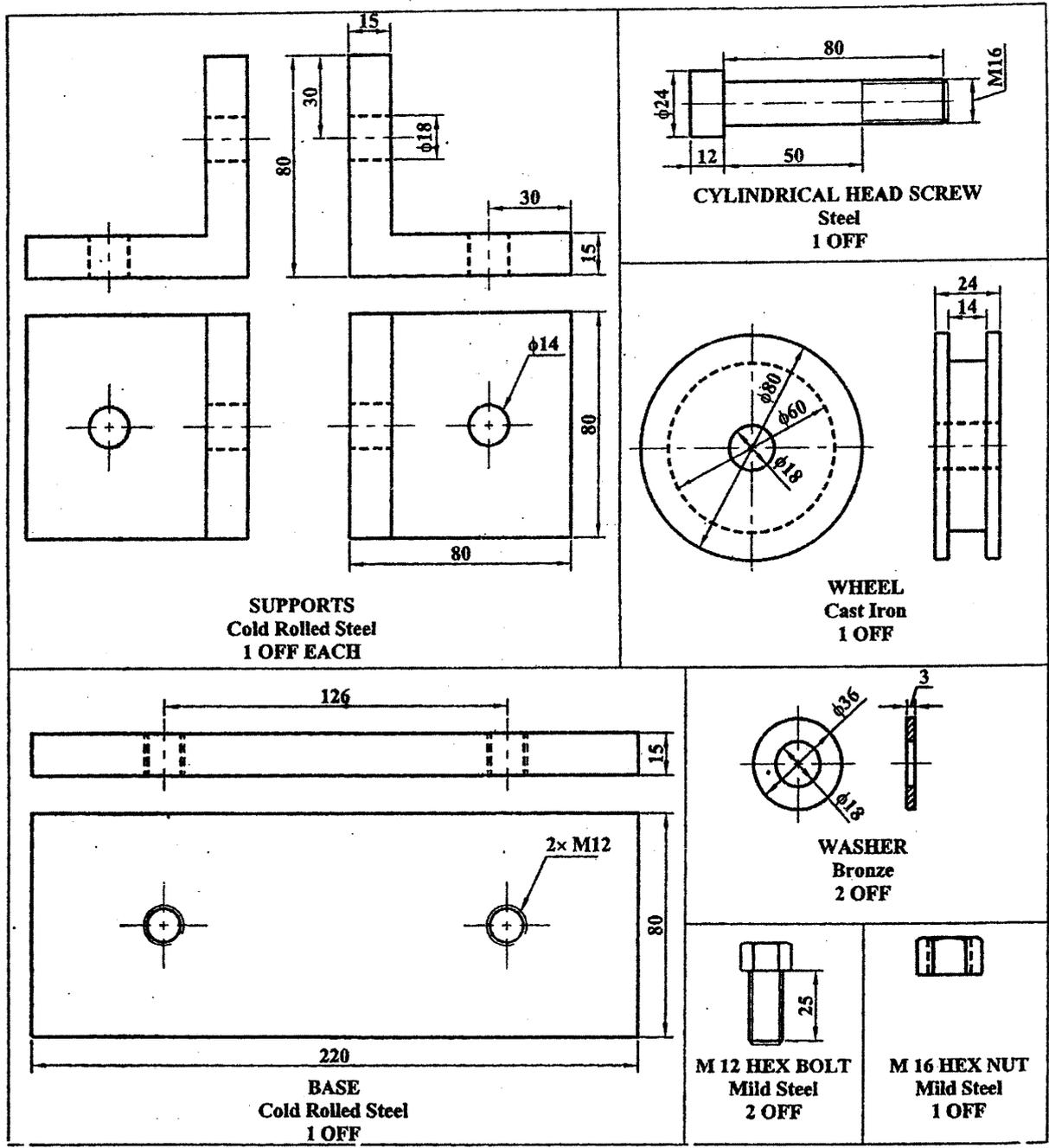
Subject: - Engineering Drawing II (ME451)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Orthographic views of an object is shown in figure below. Draw its isometric view. [10]



3. Draw the assembled sectional front view from the following detail drawings shown in figure below. [14]



2. A right regular square pyramid, base edge 30 mm and altitude 40 mm rests with its base on the ground and the base edges are equally inclined to the picture plane. The nearest front corner of the base is 10 mm behind the PP. The station point is 45 mm in front of the PP, 60 mm above the ground and lies in the central plane which passes through the vertex of the pyramid. Draw the perspective view of the pyramid.

[6]

P.T.O

4. Sketch top view and sectional front view of single riveted double strap butt joint.

[5]

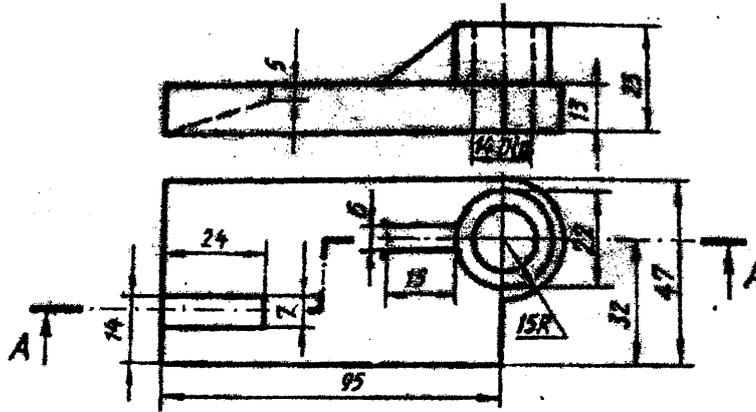
OR

Determine the limits of dimensions and types of fit designed by 100 H7/s6. Assume fundamental deviation for H and s as 0 micrometers and 0.080 mm above the basic size line respectively and International tolerance grade for 7 and 6 as 0.035 mm and 0.022 mm respectively.

[5]

5. Orthographic projection of the object is shown in figure below. Draw the sectional view at section A-A.

[5]



OR

Draw the standard symbols for the following.

a) Internal Thread

c) Spot weld

e) Surface to be obtained by fine turning

g) Rectifier

i) I - beam

b) Third angle projection

d) Expansion joint

f) Least material condition

h) Loud speaker

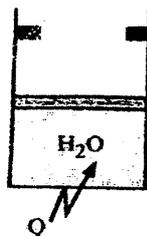
j) School

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT, BIE, B. Agri., BAME	Pass Marks	32
Year / Part	I / II	Time	3 hrs.

Subject: - Fundamental of Thermodynamic and Heat Transfer (ME452)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Necessary tables are attached herewith.
- ✓ Assume suitable data if necessary.

1. Differentiate between Microscopic and Macroscopic viewpoint. [4]
2. Define polytropic process. Sketch polytropic processes on a common graph for different values of n . Also derive an expression for work transfer for a polytropic process. [4]
3. Define the following terms: saturation temperature, superheated vapor, moisture content, critical point and specific heat at constant pressure. [4]
4. Write down expression for first law of thermodynamics for a control mass. Reduce it for a cycle process and write down statement of first law of thermodynamics for power and refrigeration cycles. [6]
5. What is the key feature of second law of thermodynamics? State and explain second law of thermodynamics for an isolated system. Also explain entropy generation. [6]
6. Explain the working principle of an Rankine with P-V and T-S diagram. [6]
7. Derive a heat flow equation through a composite plane wall consisting of three layers of different materials. [6]
8. On a new scale N of temperature the freezing point of ice and boiling point of water are 100°N and 400°N respectively. Derive an expression to convert a temperature reading on N scale to $^{\circ}\text{C}$ scale. Also determine the change in N scale when the temperature of a system increases by 50°C . [6]
9. A piston cylinder device shown in figure below contains 2 kg of water initially at a pressure of 500 KPa with a quality of 20%. The water is heated until it becomes a saturated vapor. The volume of the system when the piston is at the upper stops is 0.4m^3 . Sketch the process on P-v and T-v diagrams and determine: [8]
 - a) the final pressure, and
 - b) the total work transfer



	h_g	s_i	s_{ig}	s_g
kg	kJ/kg	kJ/kg.K	kJ/kg.K	kJ/kg.K
4.2	2746.3	1.8415	4.9971	6.8386
8.2	2748.6	1.8610	4.9604	6.8214
96.8	2752.9	1.8977	4.8917	6.7894
86.0	2756.7	1.9315	4.8286	6.7601
75.8	2760.2	1.9631	4.7699	6.7330
66.0	2763.3	1.9925	4.7154	6.7079
56.6	2766.2	2.0203	4.6642	6.6845
47.7	2768.9	2.0464	4.6161	6.6625
39.1	2771.4	2.0712	4.5706	6.6418
30.7	2773.6	2.0948	4.5274	6.6222
22.6	2775.7	2.1173	4.4863	6.6036
14.7	2777	2.1388	4.4471	6.5859

10. Air expands through an adiabatic turbine from 1000 KPa, 1000 K to 100 KPa, 400K. The inlet velocity is 10 m/s where as exit velocity is 100 m/s. The power output of the turbine is 3600 KW. Determine the mass flow rate of air, the inlet and the exit area. [Take $R = 287 \text{ J/KgK}$ and $C_p = 1005 \text{ J/KgK}$] [8]
11. An air conditioning unit having COP 50% of the theoretical maximum maintains a house at a temperature of 20°C by cooling it against the surrounding temperature. The house gains energy at a rate of 0.8kw per degree temperature difference. For a maximum work input of 1.8KW. Determine the maximum surrounding temperature for which it provides sufficient cooling. [8]
12. An ideal diesel engine has a compression ratio of 20 and uses air as the working fluid. The state of air at the beginning of the compression process is 95kPa and 20°C . If the maximum temperature in the cycle is not to exceed 2200K, determine a) the thermal efficiency and b) the mean effective pressure. [Take $C_p = 1005\text{J/kgK}$, and $\gamma = 1.4$] [8]
13. a) A hollow cylinder with inner and outer diameter of 8 cm and 12 cm respectively has an inner surface temperature of 200°C and outer surface temperature of 50°C . If the thermal conductivity of the cylinder material is 60 w/MK, determine the heat transfer from the unit length of the pipe. Also determine the temperature at the surface at a radial distance of 5 cm from the axis of the cylinder. [4]
- b) The magnitude of heat transfer through an insulating layer of 0.8 m^2 surface area, 5 cm thick and having a thermal conductivity of 0.25 W/mK is found to be 1600 W. Determine the temperature difference existing across the material. [2]

Table A2.1: Properties of SATURATED WATER – Pressure Table (Continued)

P kPa	T °C	v_l m ³ /kg	v_{lg} m ³ /kg	v_g m ³ /kg	u_l kJ/kg	u_{lg} kJ/kg	u_g kJ/kg	h_l kJ/kg	h_{lg} kJ/kg
475	149.94	0.001090	0.3013	0.3023	639.56	1927.8	2559.4	632.07	2076.7
500	151.87	0.001093	0.3038	0.3049	639.84	1921.4	2561.2	640.38	2076.6
550	155.49	0.001097	0.3045	0.3046	655.45	1908.9	2564.4	656.08	2076.5
600	158.86	0.001101	0.3145	0.3156	670.05	1897.3	2567.3	670.71	2076.4
650	162.02	0.001104	0.2915	0.2926	683.71	1886.2	2569.9	684.42	2076.3
700	164.98	0.001108	0.2717	0.2728	696.58	1875.8	2572.4	697.35	2076.2
750	167.79	0.001111	0.2544	0.2555	708.76	1865.8	2574.6	709.59	2076.1
800	170.44	0.001115	0.2393	0.2404	720.33	1856.3	2576.6	721.23	2076.0
850	172.97	0.001118	0.2258	0.2269	731.37	1847.1	2578.5	732.32	2075.9
900	175.39	0.001121	0.2138	0.2149	741.92	1838.3	2580.3	742.93	2075.8
950	177.70	0.001124	0.2030	0.2041	752.03	1829.8	2581.8	753.10	2075.7
1000	179.92	0.001127	0.1933	0.1944	761.7	1821.7	2583.1	762.83	2075.6