

2012 – 2013

B.TECH. AUTUMN (I SEMESTER) EXAMINATION
(ELECTRICAL / MECHANICAL / CIVIL / CHEMICAL / ELECTRONICS /
COMPUTER / PETRO-CHEMICAL ENGINEERING)

APPLIED CHEMISTRY – I

(AC – 101)

Credits: 03

Maximum Marks : 60

Duration : Three Hours

Note: Answer all the questions.

All questions carry equal marks.

1. (a) Describe the favourable conditions for precipitation. What is super saturation? [05]
 (b) Classify volumetric analysis with examples. Explain the terms standardization, primary standards and secondary standards. [05]

2. (a) What is the basic principle of spectrophotometry? State Beer Lambert's Law and explain the terms involved. [05]
 (b) Classify chromatography on the basis of physical mode and mechanism. [05]

- OR
2. (a) Draw a labelled diagram of a single beam spectrophotometer and mention the function of various components. [05]
 (b) Define the followings. [05]

(i) Stationary and mobile phase.	(ii) Retention Factor
(iii) Resolution	

3. (a) How air pollutants are classified on the basis of origin, chemical composition and state of matter? [05]
 (b) Discuss the sources and harmful effects of carbon monoxide in the atmosphere. [05]

4. (a) Explain the terms phase, component and degree of freedom. [05]
 (b) Draw a phase diagram of water system and explain its important features. [05]

5. (a) What is natural rubber? Describe the vulcanization of natural rubber and mention its advantages. [05]
 (b) Describe the preparation, properties and uses of any two of the followings: [05]

(i) polyethylene	(ii) polystyrene	(iii) Teflon
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6. (a) Define ceramics and classify them with suitable examples. [05]
 (b) Explain the properties and composition of some important types of glasses. [05]

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B.TECH. AUTUMN (I SEMESTER) EXAMINATION
(ELECTRICAL / MECHANICAL / CIVIL / CHEMICAL / ELECTRONICS /
COMPUTER / PETRO-CHEMICAL ENGINEERING)

APPLIED CHEMISTRY**(AC – 111)****Credits: 04****Maximum Marks : 60****Duration : Three Hours****Note:** Answer all the questions.

All questions carry equal marks.

1. (a) Give the different steps of gravimetric analysis. With the help of examples, describe the different types of precipitates formed in gravimetric analysis. [05]
- (b) List the different types of titrations and give one example of each type. What is the difference between idimetric and iodometric titrations? [05]

OR

- 1'. (a) What are the applications of chromatography? Write the chemical reactions involved in the softening of water by ion exchange method. [03]
- (b) Draw a labelled diagram for the titration of 50ml of 0.01 M HCl with 0.01M NaOH. [03]
- (c) Calculate the molar absorptivity of 0.05M solution of coloured substance found to transmit 80% of light when tested by spectrophotometer using a tube of 1.0 cm path length. [04]

2. (a) List the different steps involved in the water treatment process for municipal supply. Explain the coagulation step. [03]
- (b) Describe the scale and sludge formation in boilers and methods of their prevention. [03]
- (c) A sample of water was found to contain 300 mg/l $\text{Ca}(\text{HCO}_3)_2$, 40.0 mg/L Mg $(\text{HCO}_3)_2$, 10.0 mg/L Mg SO_4 , 25.0 mg/L CaSO_4 and 15.0 mg/L CaCl_2 . Calculate the temporary, permanent and total hardness of the water sample. Atomic weights of Mg = 24, Ca = 40, Cl = 35.5, S = 32, O = 16, H = 1 and C = 12. [04]

OR

- 2'. (a) What is break point chlorination. Give its significance. [04]
- (b) Explain any one method of removal of hardness for boiler feed water. [03]
- (c) Write the chemical reactions for the following: [03]
- (i) Hardness causing impurities and Soap
- (ii) Hardness causing impurities and EDTA

Contd.....2



3. (a) Define the higher and lower calorific values of a chemical fuel. [03]
(b) What are the advantages and disadvantages of volatile matter present in a coal sample. [03]
(c) Draw labelled diagram of Bergius process for production of synthetic petrol. [04]

OR

- (c') Calculate the minimum amount of oxygen and air required in kg for the complete combustion of 1 kg of a coal sample containing 95% carbon and remaining incombustible matter. Calculate the w/w o/o composition of dry flue gases. [04]
4. (a) Describe the mechanism of hydrodynamic lubrication. [03]
(b) List the different types of liquid lubricants. Explain the significance of compounded lubricating oils. [04]
(c) Give the conditions of use of greases. [03]
5. Differentiate between [2.5×4]
(a) Galvanic cell and concentration cell.
(b) Chemical corrosion and electrochemical corrosion.
(c) Galvanic series and electrochemical series.
(d) Cathodic coating and anodic coating to protect iron from corrosion.
6. (a) What is a polymer? Give the classification of polymers. [03]
(b) Explain the important steps of polymerization of vinylchloride by free radical mechanism. [03]
(c) Give the preparation, properties and uses of PTFE or BUNA rubbers. [04]

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B.TECH./B.ARCH. AUTUMN (I SEMESTER) EXAMINATION
(ELECTRICAL / MECHANICAL / CIVIL / ELECTRONICS / COMPUTER /
CHEMICAL / PETRO-CHEMICAL ENGINEERING)

APPLIED MATHEMATICS – I

(AM – 101)

Credits: 05

Maximum Marks : 60

Duration : Three Hours

Note: Answer all the questions.

1. (a) For what value of λ the system of equations:

[6+6]

$$2x_1 - 3x_2 + 6x_3 - 5x_4 = 3$$

$$x_2 - 4x_3 + x_4 = 1$$

$$4x_1 - 5x_2 + 8x_3 - 9x_4 = \lambda$$

is consistent? Hence solve the system for that value of λ .

- (b) Find the eigen values of eigen vectors of the matrix:

$$\begin{bmatrix} 2 & 1 & 1 \\ 2 & 3 & 2 \\ 3 & 3 & 4 \end{bmatrix}$$

OR

- (b') Find the characteristic equation of the matrix:

$$A = \begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$$

and hence find the matrix represented by

$$A^8 - 5A^7 + 7A^6 - 3A^5 + A^4 - 5A^3 + 9A^2 - A + 2I.$$

2. (a) Find the pedal equation of the parabola $y^2 = 4a(x + a)$.

[4+4+4]

- (b) Find the radius of curvature at the point (r, θ) on the curve $r^n = a^n \sin n\theta$.

- (c) Find the all possible real asymptotes of the curve :

$$4x^3 - 3xy^2 - y^3 + 2x^2 - xy - y^2 - 1 = 0.$$

OR

- (c') Trace the curve:

$$y = \frac{x^2 + 1}{x^2 - 1}, \text{ by describing the salient features.}$$

3. (a) If $y = (\sin^{-1} x)^2$, show that $(1 - x^2) y_{n+2} - (2x + 1)x y_{n+1} - n^2 y_n = 0$ and find $(y_n)_0$.

[6+6]

Contd.....2

- 2 -

OR

(a') If $y = e^{\tan^{-1} x}$, find the coefficient of x^5 in the expansion of y by Maclaurin's series.

(b)

(i) Test for convergence the series whose general term is $\frac{\sqrt{n}}{n^2 + 1}$.

(ii) Test the convergence of the series:

$$1 + \frac{1}{2}x + \frac{1}{5}x^2 + \frac{1}{10}x^3 + \dots + \frac{x^n}{n^2 + 1} + \dots$$

4. (a) If S be the length of the arc of the catenary $y = c \cosh(x/c)$ from the vertex $(0, c)$ to the point (x, y) , show that [6+6]

(i) $s^2 = y^2 - c^2$ (ii) $s = c \tan \psi$.

(b) Find the volume of the solid generated by the revolution of the curve $y(a^2 + x^2) = a^3$ about its asymptote.

OR

(b') Find the area of the curved surface of the cup formed by the revolution about its axis of the smaller part of the parabola $y^2 = 4ax$ cut off by the line $x = 3a$.

5. (a) Solve any TWO of the following D.E: [6+6]

(i) $(1 + xy)y \, dx + (1 - xy)x \, dy = 0$.

(ii) $\frac{d^2 y}{dx^2} + 4y = \sin^2 x + xe^x$.

(iii) $x^2 \frac{d^2 y}{dx^2} - x \frac{dy}{dx} + y = 2 \log x$.

(b) The radial displacement u in a rotating disc at a distance r from the axis is given

by $r^2 \frac{d^2 u}{dr^2} + r \frac{du}{dr} - u + kr^3 = 0$, where k is constant. Solve the equation and

determine the constants so that $u = 0$ when $r = 0$ and $r = a$.

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B.TECH./B.ARCH. AUTUMN (I SEMESTER) EXAMINATION
(ELECTRICAL / MECHANICAL / CIVIL / ELECTRONICS / COMPUTER /
CHEMICAL / PETRO-CHEMICAL ENGINEERING)

MATHEMATICS - I**(AM - 111)****Credits: 04****Maximum Marks : 60****Duration : Three Hours****Note: Answer all the questions.****Programmable calculators is not allowed.**

1. (a) Find the rank of the matrix:

$$A = \begin{bmatrix} 1 & 2 & 3 & 0 \\ 2 & 4 & 3 & 2 \\ 3 & 2 & 1 & 3 \\ 6 & 8 & 7 & 5 \end{bmatrix}$$

- (b) Find the values of λ for which the following system of equations is consistent and has non-trivial solutions. Solve the system for each value of λ .

$$(\lambda - 1)x + (3\lambda + 1)y + 2\lambda z = 0$$

$$(\lambda - 1)x + (4\lambda - 2)y + (\lambda + 3)z = 0$$

$$2x + (3\lambda + 1)y + 3(\lambda - 1)z = 0$$

- (c) Find Adj A by using Cayley-Hamilton theorem where

[4+6+5]

$$A = \begin{bmatrix} 1 & 2 & 1 \\ 0 & 1 & -1 \\ 3 & -1 & 1 \end{bmatrix}$$

2. (a) Use Taylor's theorem to express the polynomial $2x^3 + 7x^2 + x - 6$ in powers of $(x - 2)$.

- (b) If $\cos^{-1}\left(\frac{y}{b}\right) = \log_e\left(\frac{x}{a}\right)^n$, show that $x^2 y_{n+2} + (2n + 1)x y_{n+1} + 2n^2 y_n = 0$.

- (c) Show that eight points of intersection of the curve

$$x^4 - 5x^2 y^2 + 4y^4 + x^2 - y^2 + x + y + 1 = 0$$

and its asymptotes lie on a rectangular hyperbola.

OR

- (c') Trace the curve $y = \frac{x^2 + 1}{-1 + x^2}$, describing its salient features.

[4+5+6]

Contd.....2

3. (a) Find the intrinsic equation of the cycloid $x = a(t + \sin t)$, $y = a(1 - \cos t)$.
 (b) The area cut off from the parabola $y^2 = 4ax$ by the chord joining the vertex to an end of the latus rectum is rotated about the chord. Find the volume of the solid so formed.

OR

- (b') Show that the surface area of the solid generated by revolving one complete arc of the cycloid $x = a(\theta - \sin \theta)$, $y = a(1 - \cos \theta)$ about a line $y = ca$, is $\frac{32}{3}\pi a^2$. [7+8]

4. (a) Solve any three of the following :

(i) $\frac{x dy + y dx}{x^2 + y^2} = 0$

(ii) $\frac{d^2 y}{dx^2} + y = \operatorname{cosec} x$

(iii) $\frac{d^2 y}{dx^2} - 4 \frac{dy}{dx} + 4y = 8(e^{2x} + \sin 2x + x^2)$

(iv) $x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} + y = \log x \sin(\log x)$

- (b) Solve the following system of differential equations.

$$\frac{dx}{dt} + \frac{dy}{dt} - 2y = 2 \cos t - 7 \sin t$$

$$\frac{dx}{dt} - \frac{dy}{dt} + 2x = 4 \cos t - 3 \sin t$$

OR

- (b') A particle of mass m is projected vertically upward under gravity, the resistance of the air being mk times the velocity. Show that the greatest height attained by the particle is $\frac{v^2}{g} [\lambda - \log(1 + \lambda)]$, where v is the terminal velocity of the particle and λv is the initial velocity. [9+6]

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B.TECH. AUTUMN (I SEMESTER) EXAMINATION

(Civil/Chemical/ Computer/ Electrical/ Electronics/ Mechanical//Petro-Chemical Engg.)

APPLIED PHYSICS-I (AP-101)

Credit:03

Maximum Marks:60

Duration: Three Hours

Answer all questions. Symbols have their usual meaning.

- 1.(a) What is Hall effect? Obtain an expression for majority carrier concentration in a given sample in terms of measurable parameters. Mention few applications of Hall effect. 8

OR

- (a') Define mobility of an electron. Obtain an expression for total current density in case of a semiconductor hence write expression for electrical conductivity due to electrons and holes both. 8
- (b) Discuss the formation of n and p type semiconductors with the help of energy band picture. 4
- (c) A Si sample is doped with 10^{17} As atoms/cm³. Where is E_F relative to E_i at 300 K? (Given: $n_i = 1.5 \times 10^{10}$ cm⁻³ and $k_B = 1.38 \times 10^{-23}$ J/K) 3

- 2.(a) What is the inertial frame of reference? Starting with proper relationship between x and x' obtain Lorentz transformation equations. 7
- (b) Write down Maxwell's equations. Give a qualitative treatment of the traveling electromagnetic wave and show that $E_m/B_m = c$ 5
- (c) An astronaut whose height is exactly 1.8 meter is lying parallel to the axis of a spacecraft moving at $0.90c$ relative to the earth. What is the height as measured by an observer in the same space craft? By an observer on the earth? 3

- 3.(a) With the help of suitable diagram discuss the production mechanism of x-rays and explain the terms: Duane-Hunt limit, continuous and characteristic x-rays. 11
- (b) Electrons are accelerated in a T.V. tube through a potential difference of about 11 kV. What is the nature and the maximum frequency of the e.m. waves emitted when these electrons strike the screen of the tube (Assume $c = 3 \times 10^8$ m/s). 4

OR

- 3'(a) Discuss in brief the Compton effect. What inference do you draw from this effect? Obtain analytically the expression: $\lambda' - \lambda = \frac{h}{m_0 c} (1 - \cos \phi)$. 9
- (b) An x-ray photon having frequency 1.5×10^{19} Hz undergoes Compton scattering with an electron and emerges with a frequency of 1.2×10^{19} Hz. Find the kinetic energy (in joules) imparted to the electron. ($h = 6.63 \times 10^{-34}$ J.s) 3
- (c) What is uncertainty principle? Write various uncertainty relations that you know. 3

- 4.(a) Discuss the physical significance of a wave function. Set up the time dependent form of Schrödinger equation and hence obtain its steady state form. 10
- (b) The phase velocity of the ripples on liquid surface is $\sqrt{\frac{2\pi S}{\lambda \rho}}$ where S and ρ are respectively surface tension and density of the liquid. Find the group velocity of the ripples. 3
- (c) What is tunnel effect? Give an example of this effect. 2

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B. TECH. AUTUMN (I SEMESTER) EXAMINATION
**(ELECTRICAL/MECHANICAL/CIVIL/ CHEMICAL/ PETRO-
 CHEMICAL/ELECTRONICS/COMPUTER ENGINEERING)**
APPLIED PHYSICS

(AP-111)

Maximum Marks: 60

Credits-04

Duration: Three Hours

Answer all questions. Symbols have their usual meaning.

- 1(a) Write down Fermi Dirac distribution function and define Fermi energy E_F . 8.0
 Obtain an expression for equilibrium concentration of electrons in conduction band in case of a semiconductor and show that product of n_0 and p_0 is constant for a given semiconductor.

OR

- (a) What are direct and indirect band gap semiconductors? Derive an expression for electrical conductivity in case of a semiconductor taking the contribution of electron and holes both. 8.0
- (b) Discuss superconductivity with the help of suitable diagram. Define the terms: transition temperature (T_c) and critical magnetic field (B_c). 4.0
- (c) The actual energy gap at 0 K in lead is 2.73×10^{-3} eV. Find out T_c and minimum frequency of radiation to break Cooper pair in lead at 0 K. 3.0
- 2(a) Describe in detail the construction and working of Ruby laser with help of suitable diagrams. Mention one of the major drawbacks of Ruby laser. 6.5
- (b) On what principle optical fiber works? Draw a cross section of an optical fiber and name its different components. What are the advantages of optical fiber using in communication? 5.0
- (c) A typical ruby laser emits radiation of 694.3 nm because of transition between the energy levels of Cr^{3+} ions. If a ruby is 5 cm long and 1 cm in diameter contains 10^{19} ions of Cr^{3+} . What is the maximum energy of a pulse radiation emitted by the laser? 3.5
- 3(ai) Explain pair production and show that it cannot occur in empty space.
- (a) An x-ray photon of initial frequency 3.0×10^{19} Hz collides with an electron and is scattered through 90° . Find its new frequency. 4.0
- (b) Differentiate between phase and group velocities. An electron and a proton have the same velocity. Compare the wavelengths and the phase and group velocities of their de Broglie waves. 4.0
- (c) Write down time independent Schrödinger equation and solve it for the wave function of a particle trapped in a box (infinite square potential well). 5.0
- (d) Find the expectation value, $\langle x \rangle$ of the position of a particle trapped in a box L wide. 2.0
- 4 (b) Compare the three statistical distribution functions. Show the variation of these distribution functions as a function of energy (for $\alpha = -1$). 4.0
- (b) Plot the electron-energy distribution in metals and hence discuss as to why the electrons in general, do not contribute to specific heat of metals? 2.0

Q (ii)

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- (c) What do you mean by nuclear cross section? Show that the number of surviving particles N decreases exponentially with increasing slab thickness x for a given material. 4.0
- (d) What is the general working principle of nuclear detectors? Give a detailed account of Scintillation detector. 5.0

Some useful physical constants

$$h = 6.63 \times 10^{-34} \text{ J.s,}$$

$$k_B = 1.38 \times 10^{-23} \text{ J/K,}$$

$$m_e = 9.1 \times 10^{-31} \text{ kg,}$$

$$c = 3 \times 10^8 \text{ m/s}$$

$$q_e = 1.6 \times 10^{-19} \text{ C}$$

2012-13
B. Arch. (First Semester) Examination
AR 103, Architectural Drawing – I
Credits: 4

Maximum Marks: 40

Duration Three hours

Note: -

1. Attempt all questions.
2. Good drafted drawing will be credited.
3. Assume any missing data.
4. All dimensions are in mm.

Q1 Represent the followings:-

- | | |
|--|---|
| a) An architecture student with drawing sheet in elevation. | 3 |
| b) Palm tree in elevation and plan. | 3 |
| c) Any two different kind of textures (in box size 80 mm X 120 mm) | 4 |

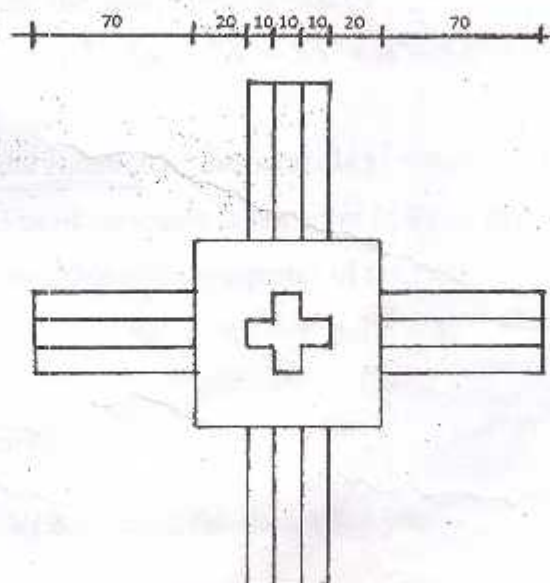
Q2. Draw orthographic projection of a square prism of base 30 mm x 30 mm and height 60 mm, resting on ground on one of its base edge in such a way that its central longitudinal axis is inclined at $<60^\circ$ to ground & edge touching the ground is making $<45^\circ$ to vertical plane. 10

OR

Q2 Draw orthographic projection of a cube of side 50 mm resting on one of its corner on ground in such a way that one of its solid diagonal is perpendicular to vertical plane. 10

Q3. Draw surface development of a sphere of diameter 30 mm. 10

Q4. Draw isometric view of the object shown in figure 1 10



PLAN AND ALL ELEVATIONS
FIGURE - 1

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B.ARCHITECTURE. AUTUMN (I SEMESTER) EXAMINATION
PRINCIPLES AND PHILOSOPHY OF ARCHITECTURE

(AR – 112)

Credits: 03

Maximum Marks : 60

Duration : Three Hours

Note: Explain all the questions, each question carry equal marks.
Support your answers with suitable sketches.

1. What do you understand by the term Architecture? Explain the role of Architecture in India. [10]
 2. What are the basic elements of design, explain their role with neat sketches? [10]
 3. What are the allied subjects which have direct impact on Architecture? Explain the saying "Architecture is Mother of all Arts & Sciences" in this context. [10]
 4. Explain any two of the following : [5×2=10]
 - (a) Symmetry
 - (b) Axis
 - (c) Rhythm
 5. Explain the philosophy of any one of the following Architects and how it is projected in their important works? [10]
 - (a) Mies Vander Rohe
 - (b) Le Corbusier
 6. Explain the role of hierarchy as the indispensable principle of design? [10]
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B.ARCH./B.TECH.AUTUMN (I SEMESTER) EXAMINATION
(ELECTRICAL/MECH./CIVIL/CHEM/ELECTRONICS/COMPUTER/
PETROCHEMICAL ENGINEERING)
ENVIRONMENTAL STUDIES

(CE-111)

Credits: 04

Maximum Marks: 60

Duration: Three Hours

Answer all questions

Assume missing data suitably

1. (i) Determine the effective height of a stack : given the following data
 - a) Physical stack is 180 m tall and has 0.95m inside diameter
 - b) Wind velocity is 2.75m/s
 - c) Air temperature is 20°C
 - d) Barometric pressure is 1000 milli bars
 - e) Stack gas velocity is 11.2 m/s
 - f) Stack gas temperature is 160°C

(6)
 - (ii) Discuss any one of the following in relation to the control of particulates
 - a) Settling Chamber
 - b) Bag house Filter
 - c) Cyclone Separator

(4)
- OR
1. A coal burning power plant burns 6.25 tonnes of coal per hour and discharges the combustion products through a stack and has an effective height of 80 m. The coal has sulphur content of 4.7% and wind velocity at the top of the stack is 8.0 m/s. Atmosphere stability conditions are moderately to slightly stable. Determine the maximum ground level concentration of SO₂ and the distance from the stack at which it occurs.

(10)
 2. (i) Write about the various components of municipal solid waste

(4)

 (ii) Which properties a waste should have to be classified it as hazardous solid waste

(2)

 (iii) Describe in brief the biological or thermal process for the resource recovery through waste processing.

(4)
 3. (i) Draw the treatment scheme for ground water. Briefly explain the purpose of each unit.

(5)

OR

 (ii) Explain the filtration process in water treatment

(5)

 (iii) Design a sedimentation tank for water treatment for a population of 10,000 persons using 150L of water per day.

(5)
 4. (i) Explain the low cost wastewater treatment process.

(5)

 (ii) The 5 day BOD at 20 °C of a wastewater sample is 300 mg/L. Find 12 day BOD when the temperature was 30 °C. Take $k=0.23d^{-1}$. Why Bureau of Indian standards recommends 3 day BOD at 27°C.

(5)
 5. (i) How air pollutants are classified on the basis of origin, chemical composition and state of matter?

(5)

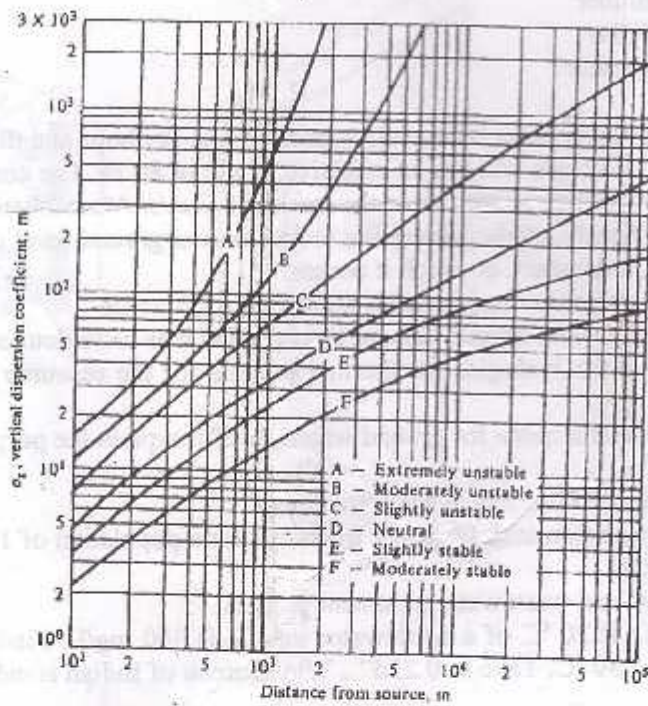
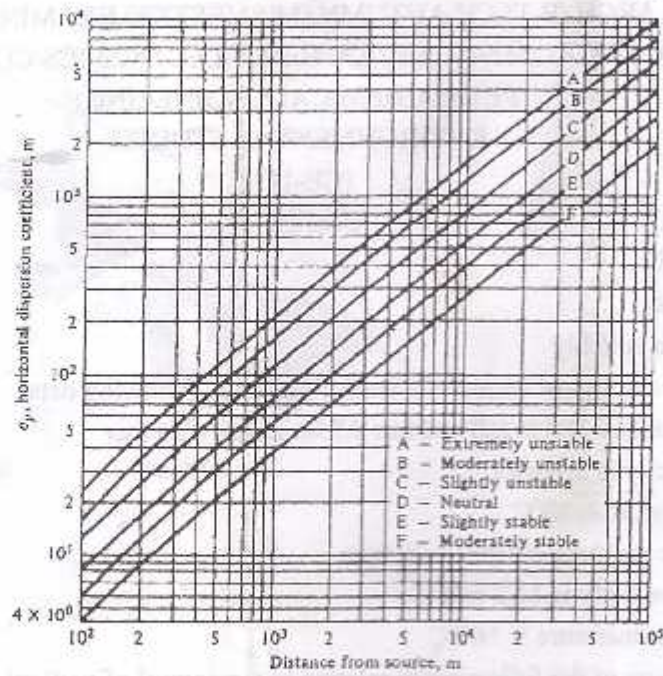
 (ii) Describe the biotic and abiotic components of an ecosystem with suitable examples.

(5)
 6. (i) Explain the significance of various chemical and biological parameters used to characterize water quality.

(5)

 (ii) What is the significance of biochemical oxygen demand (BOD)? Describe the suitable method for the determination of BOD in wastewater sample.

(5)



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**B.ARCH/ B.TECH (I-SEMESTER) EXAMINATION
(ELECT./MECH./CIVIL./CHEM./ELECTRONICS/COMPUTER/
PETRO-CHEM.ENGINEERING)
BASIC ELECTRICAL ENGINEERING**

(EE-101)

Maximum Marks:60**Credits:03****Duration: Three Hours****Answer all questions****Assume suitable value for missing data, if any.****All symbols and abbreviation have there usual meanings.**

1.(a) State Norton's theorem as applicable to a.c network. Discuss how the Thevenin's equivalent can be obtained from the Norton's equivalent. **05**

(b) Calculate the current, power and power factor for each branch and also calculate the total current, power, and power factor for overall circuit shown in Fig1. Draw neat phasor diagram for the circuit. **07**

OR

1(a) Derive an expression that relates the line and phase voltages of a star connected circuit with the help of phasor diagram. **05**

(b) Use Thevenin's theorem to calculate current in a 1000 ohm resistor connected between terminals A and B as shown in Fig.2 **07**

2(a) Explain the principle of working of a transformer. What is meant by step up and step down transformers? **05**

(b) An inductor has a core built up of stampings as shown in Fig.3 the coil being on the center limb. There is a 1mm air gap in the center limb which has a cross-sectional area of 4 cm^2 . All the other path in the core have a cross-sectional area of 2 cm^2 . The mean path length of the core is shown. If the relative permeability of the iron is 800, find the current needed in the coil of 500 turns to produce a total flux in the air gap of 0.8 mWb. **07**

OR

2(a) Define magnetic field intensity and reluctance. Explain how the hysteresis loss and magnetic loss occur in a ferromagnetic materials. **05**

- (b) A 25 kVA, 2,200/200 V, 50Hz single phase transformer has primary and secondary resistances of 0.8Ω and 0.009Ω and leakage reactances of 3.2Ω and 0.3Ω respectively. Calculate. 07
- (i) the equivalent impedance as referred to primary and secondary side.
- (ii) the total copper loss using the individual resistances of the two windings and by using equivalent resistances as referred to each side.
- 3.(a) Using suitable derivation explain how rotating magnetic field is produced in a three phase induction motor. 05
- (b) Derive an emf equation of an alternator. A 3-phase, 6 pole star connected alternator revolves at 1000 rpm. The stator has 90 slots and 8 conductors per slot. The flux per pole is 0.05 Wb (sinusoidally distributed). Calculate the voltage generated by the machine if the winding factor (K_w) is 0.96. 07
- OR
- 3'(a) Describe the constructional differences between a salient pole and cylindrical rotor of an alternator. 05
- (b) Explain why the single-phase induction motor is not self starting? Explain any one method to make the single-phase induction self starting. State two applications of such motors. 07
- 4(a) Explain the working of a PMMC instrument. Why this is not suitable for AC measurement? 05
- (b) Describe the constructional details of a single phase induction type energy meter. Show that the number of revolutions in this energy meter is proportional to energy consumed. 07
- 5(a) Draw the layout of a power system indicating various voltage levels. 05
- (b) (i) Name the main parts of nuclear reactor. With the help of suitable diagram explain any one of them. 07
- (ii) Write short note on pumped storage plant.

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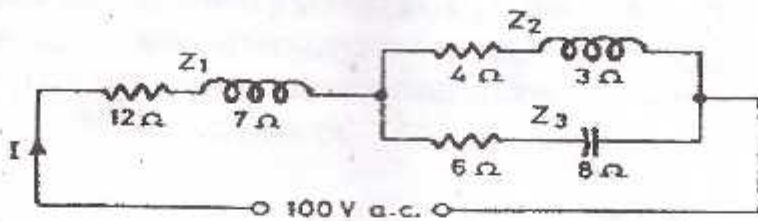


Fig.1

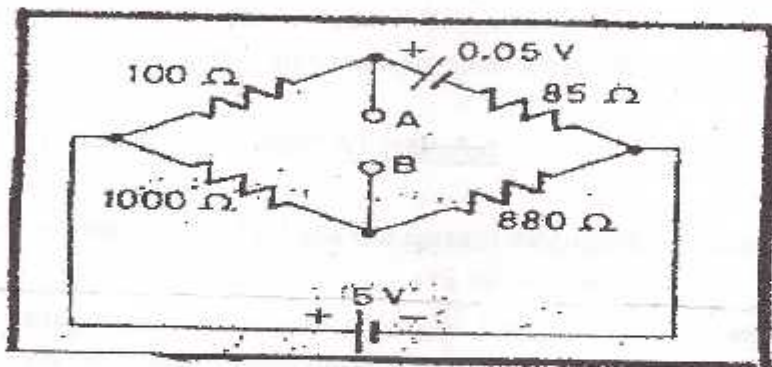


Fig.2

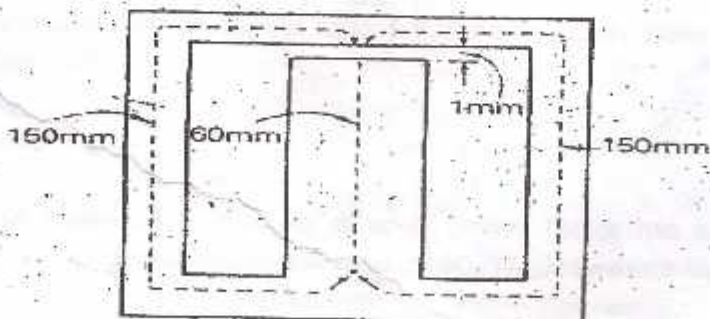


Fig.3

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B.TECH/B.ARCH AUTUMN (I SEMESTER) EXAMINATION

CIVIL/ELECTRICAL/ELECTRONICS/COMPUTER/CHEMICAL/PETRO-CHEMICAL & MECHANICAL ENGINEERING)

BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING (EE-111)

Credits: 04

Maximum Marks: 60

Duration: Three Hours

Note:

1. Answer all questions.
2. Symbols and abbreviations have their usual meanings.
3. Any missing data may be suitably assumed.
4. Part A (Q.1&2) and Part B (Q.3&4) questions are to be attempted in separate copies.

PART A (30 Marks)

- (a) Using thevenin's theorem determine the current through 4Ω resistor of figure 1 (05)
- (b) A cast steel magnet has an air gap of length 2 mm and an iron path of 30 cm. Find the number of ampere turns necessary to produce a flux density 1.2 Wb/m^2 . The relative permeability of cast steel is 900. Neglect leakage and fringing. (05)
- (c) Define magnetomotive force, reluctance, permeability. State ampere's circuital law. (05)

OR

- (a) Find the sinusoidal expression for the voltage V_c for the system shown in figure 2 if
 $e_{in} = 120 \sin(\omega t - 30^\circ)$
 $V_a = 60 \cos \omega t$
 $V_b = 30 \sin \omega t$
 Also draw the phasor diagram. (05)
- (b) A single phase transformer working at unity power factor has an efficiency of 90% at both half load and at the full load of 600W. Determine the efficiency at 85% full load and the maximum efficiency. (05)
- (c) Differentiate between real and reactive power.
 Derive the general expression for real and reactive power. Also give their values for purely resistive load, purely inductive load. (05)

2. (a) "Three phase induction motor is a self starting motor". Justify the statement. How can we reverse the direction of rotation of a three phase induction motor? (05)
- (b) With the help of a diagram explain the construction of induction type of energy meter. Also show that the number of revolutions is proportional to energy consumed. (05)
- (c) Draw the water-steam flow diagram of a coal fired thermal power plant. Explain the functions of economizer and superheaters. (05)

PART-B(30 Marks)

3. (a) What is the significance of diode model? Draw the equivalent circuits and characteristics of a PN junction diode for piecewise linear model, the constant voltage drop model and ideal diode model. (05)
- (b) (i) Why collector current I_C in a transistor is slightly less than the emitter current I_E for a transistor in active region.
(ii) Why Base current in a transistor is usually much smaller than I_E or I_C in active region? (05)
- (c) A Silicon junction diode with $\eta = 1$ has $v = 0.7V$ at $i = 1mA$. Find the voltage drop at $i = 0.1mA$ and $i = 10mA$. (05)
4. (a) What is the significance of DC load line in a transistor? And what are the parameters to determine the Q-point. (05)
- (b) What is the major difference between Enhancement and Depletion MOSFET? Explain with the help of diagram? (05)
- (c) For the circuit shown in figure 3, draw the DC load line and determine the Q-point. If zero signal base current is $40\mu A$ and $\beta = 50$. (05)

OR

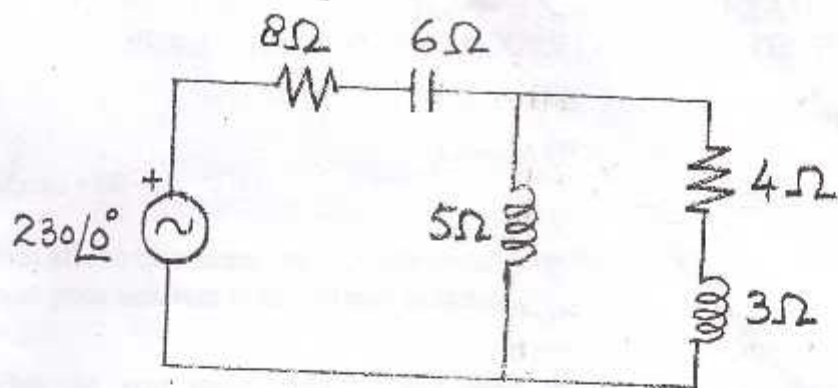
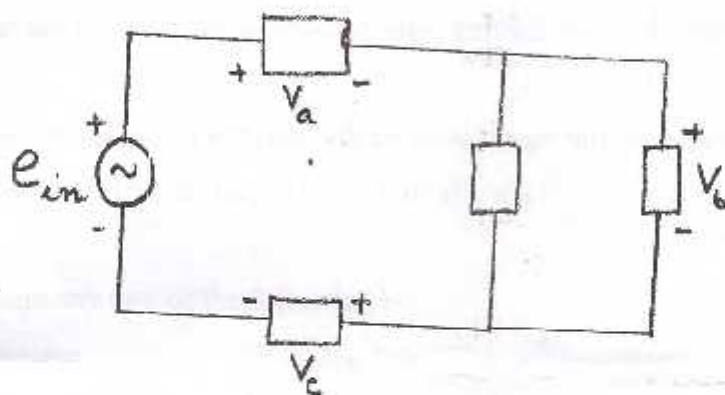
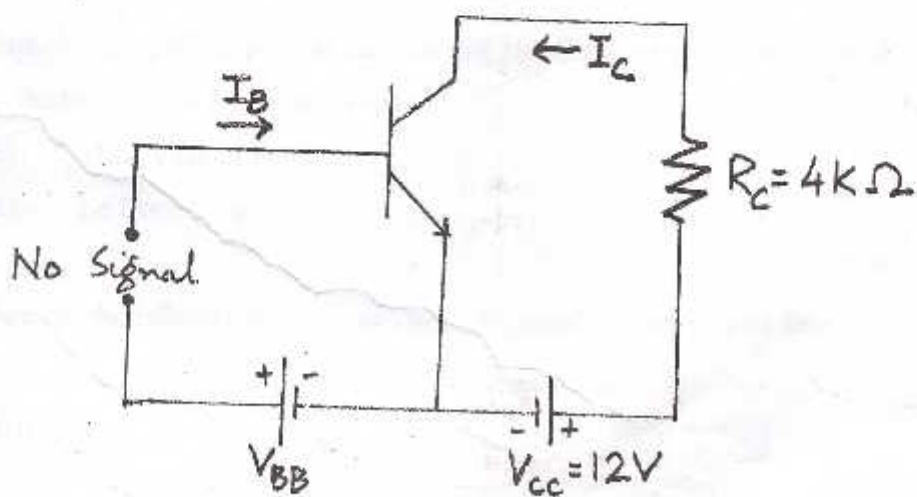
5. (a) What is inversion layer? How it is created in N-Channel Enhancement MOSFET? (05)
- (b) Draw the circuit of unity gain amplifier, and find out its voltage gain in DB. (05)
- (c) Draw the symbol of open loop operational amplifier and explain the terms virtual short and virtual ground in an operational amplifier? (05)



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Code No. 3027

FIGURE:1FIGURE:2FIGURE:3

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**B.ARCH. / B.TECH. AUTUMN (I SEMESTER) EXAMINATION
(ELECT./ MECH./CIVIL / CHEM. / ELECTRONICS / COMPUTER /
PETRO-CHEMICAL ENGINEERING)**

ENGLISH

(EN-101)

Credits: 04

Maximum Marks: 60

Duration: Three Hours.

Answer all questions.

1.(a) Read the passage and answer the questions that follow:

5x2=10

It is a remarkable fact that one's intuition is often not very good at estimating answers to probability problems. For e.g. how many persons must there be in a room in order that the odds be favourable - that is, better than even - that there are at least two persons in the room with the same birthday? Remembering that there are 365 separate birthdays possible, some persons estimate that there would have to be 50 or even 100, persons in the room to make the odds better than even. The answer, in fact, is that the odds are better than even when there are 23 persons in the room; with 40 persons, the odds are better than eight to one that at least two will have the same birthday.

Let us consider one more e.g.: Everyone is interested in polls, which involve estimating the opinions of a large group by determining the opinions of a sample. In statistics the whole group in question is called 'universe' or 'population'. Now suppose you want to consult a large enough sample to reflect the whole population with at least 98% precision / accuracy in 99 out of a hundred instances; how large does this very reliable sample have to be? If the population numbers 200 persons, then the sample must include 105 persons, or more than half the whole population. But suppose the population consists of 10,000 or 1,00,000 persons? In the case of 10,000 persons, a sample would have to consist of 213 persons, the sample increases by only 108 when the population increases by 9,800. And if you add 90,000 more to the population, you have to add only 04 to the sample. The less credible this seems to you, the more strongly I make the point that it is better to depend on the theory of probability rather than on intuition.

- (i) Identify the faculty discredited while seeking statistical solutions in the passage?
- (ii) What do you understand by 'odds be favourable' in the passage?
- (iii) Make the following words negative -
(a) precision (b) accuracy
- (iv) What terms are employed in statistics to denote 'sample'?
- (v) Which theoretical premise is found more reliable by the author?

2.(a) Describe the year 802701 AD?

05

OR

Discuss the Elois.

- (b) Elaborate the concept of 'Animalism'.

05

OR

Describe the challenges and setbacks the animals faced in building 'the Windmill'.

3. Write the process of opening a Savings Bank Account.

10

OR

Write a report on your experience of the 1st Semester that you are completing at Zakir Hussain College of Engineering and Technology, A.M.U.

4. Read the following passage:

10

Quasi- stars are a new phenomenon in the universe, and everybody is wondering what they are. Their light seems too bright to come from any known physical process. They broadcast powerful radio waves which may vary in strength. Some of them lie near the limits of observable space and time, and promise to provide a crucial test of rival theories of the universe.

Quasi- stars were discovered in 1963 as a result of an effort to overcome the shortcomings of radio telescopes. Compared to optical telescopes, these are blunt instruments. They can spot a radio star but can give only the most general clues as to its distance or nature. Progress depends on identifying radio stars with some kind of object emitting visible light – but radio astronomers can give their optical colleagues only rather imprecise directions as to where to look.

It occurred to Cyril Hazard radio astronomer working at Jodrell Bank in England, that the moon could help. By waiting for it to eclipse radio star, and timing the eclipse very precisely, a much more accurate position could be calculated. When astronomers look at the sky, they expect to see either a star or a galaxy

Make notes and write a summary of the passage given above.

- 5.(a) Using appropriate words from the given list, fill in the blanks in the following:

10

The scientist or technologist uses many _____ when he tries to _____ a problem. For instance, an engineer who wants to _____ liquid from one _____ to another has the choice of several different _____.

[raise, procedures, level, methods, solve]

- (b) Write an essay on any one of the following topics in about 400 words:

10

- (i) Scientific progress and ethics
- (ii) My favourite book

Assume any suitable data if missing.

Use of Steam Tables is allowed.

Q1-a Define: Property, Intensive property & State. 03

- b. A platinum wire is used as resistance thermometer. The wire resistance was found to be 10 ohm and 16 ohm at ice point and steam point respectively, and 30 ohm at sulfur boiling point of 444.6°C . Find the resistance of the wire at 500°C , if the resistance varies with temperature by the relation:
 $R = R_0 (1 + \alpha T + \beta T^2)$ 04

- c. In the figure, the piston diameters are $D_1 = 10\text{ cm}$ and $D_2 = 4\text{ cm}$. If $P_1 = 1000\text{ kPa}$ and $P_3 = 500\text{ kPa}$, what is the pressure in chamber 2, in kPa? 05



- Q2-a. In a steady flow open system a fluid substance flows at the rate of 4 kg/s . It enters the system at a pressure of 600 kN/m^2 , a velocity of 220 m/s , internal energy 2200 kJ/kg and specific volume $0.42\text{ m}^3/\text{kg}$. It leaves the system at a pressure of 150 kN/m^2 , a velocity of 145 m/s , internal energy 1650 kJ/kg and specific volume $1.5\text{ m}^3/\text{kg}$. During its passage through the system, the substance has a loss by heat transfer of 40 kJ/kg to the surroundings. Determine the power of the system, stating it is from or to the system. Neglect any change of gravitational potential energy. 06

- b. A system consisting of mixture of air and gasoline vapour at an initial temperature of 15°C is contained in a rigid vessel. The mixture undergoes the following processes in sequence: 06
- The mixture temperature is raised to 200°C by a heat transfer of $+3\text{ kJ}$.
 - The mixture is ignited and burns completely; this process is adiabatic and the temperature rises to 1500°C .
 - The temperature of the products of combustion is reduced to 120°C by a heat transfer of -32 kJ .
- Evaluate the energy of the system after each process given that the initial energy of the system is 10 kJ .

Q2'-a. Prove that energy is a property.

04

- b. An indicator spring is found to require an axial force of 60 N to shorten it by 1.0 mm. The spring is used in an indicator having a piston area of 4 cm^2 and a pencil mechanism which magnifies the motion of the indicator piston six-fold.

(i-) Calculate the spring number in N/m^3 .

(ii-) A single-cylinder, single-acting, 4-stroke gas engine of 150 mm bore develops an indicator power of 4.5 kW when running at 216 rev/min. Calculate the area of the indicator diagram that would be obtained using the above indicator, given that the length of the diagram is 0.1 times the length of the stroke of the engine.

Q3. (i) A rigid vessel of volume 0.58 m^3 contains 1 kg of steam at a pressure of $300 \times 10^3 \text{ N/m}^2$. Evaluate the specific volume, the temperature, the dryness fraction, the internal energy and the enthalpy of the steam.

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(ii) Heat transfer to the steam causes its temperature to rise to 160°C . Show the path of this process on a sketch of the p-v diagram and evaluate the pressure, the increase in enthalpy, the increase in internal energy of the steam and the heat transfer. Evaluate also the pressure at which the steam becomes dry-saturated.

OR

Q3'-a. A pure substance is contained in a cylinder closed by a piston. A paddle wheel, rotated by means of a shaft protruding through the cylinder wall, causes the substance to undergo a fully-resisted constant pressure process as the piston moves outwards. There is no heat transfer during the process. Show that the stirring work done on the substance is equal to the increase in the enthalpy of the substance.

05

- b. A sample of wet steam from a steam main flows steadily through a partially open valve into a pipe-line in which is fitted an electric coil; the valve and the pipe-line are well insulated. The steam mass flow rate is 0.007 kg/s while the coil takes 3.78 amperes at 230 Volts. The main pressure is $400 \times 10^3 \text{ N/m}^2$ and the pressure and temperature of the steam downstream of the coil are $200 \times 10^3 \text{ N/m}^2$ and 155°C respectively. Steam velocities may be assumed to be negligible.

07

(i) Evaluate the dryness of the steam in the main.

(ii) State, with reasons, whether an insulated throttling calorimeter could have been used for this test.

Q4-a. Define :

05

(i) Heat Engine

(ii) Reversible engine

(iii) Reversible process

- b. Establish the equivalence of Kelvin-Planck & Clausius statements of Second Law of Thermodynamics.

07

OR

A vapour-compression refrigerator uses methyl-chloride as the working fluid. The fluid flows steadily into the compressor at a pressure of $119 \times 10^3 \text{ N/m}^2$ and is delivered to the condenser as dry saturated vapour at a pressure of $653 \times 10^3 \text{ N/m}^2$. The fluid leaves the condenser as saturated liquid at a pressure of $653 \times 10^3 \text{ N/m}^2$ and after expansion in the throttle valve to pressure of $119 \times 10^3 \text{ N/m}^2$, it flows through the evaporator and thence back into the compressor again. The compression process may be assumed to be reversible and adiabatic and the throttling process to be adiabatic. Changes in kinetic energy and in elevation are negligible.

- Evaluate the dryness fraction of the fluid entering the compressor and hence the shaft work done per unit mass of refrigerant.
- Evaluate the dryness fraction of the fluid after the throttling process.
- Evaluate the heat transfer per unit mass to the refrigerant in the evaporator.
- Evaluate the coefficient of performance of the refrigerator and compare it with the value for a reversed Carnot cycle operating between the given temperature limits.

Use the data for methyl-chloride given below:

Pressure N/m^2	Saturation temperature $^\circ\text{C}$	Specific enthalpy kJ/kg		Specific entropy kJ/kg-K	
		Saturated liquid	Saturated vapour	Saturated liquid	Saturated vapour
119×10^3	-20	30.1	455.2	0.124	1.803
653×10^3	30	108.6	478.7	0.406	1.627

Q5-a. Briefly explain the mechanisms of conduction, convection and radiation modes of heat transfer. 04

- b. A 100 mm diameter steam main is covered by two layers of lagging. The inside layer is 40 mm thick and has a coefficient of thermal conductivity of 0.07 W/m-K . The outside layer is 25 mm thick and has a coefficient of thermal conductivity of 0.1 W/m-K . The main conveys steam at a temperature of 235°C . The outside temperature of the lagging is 24°C . If the steam main is 20 m long, determine: 08

- The heat lost per hour
 - The interface temperature of the lagging
- Neglect the temperature drop across the steam main.

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B.TECH. AUTUMN (I SEMESTER) EXAMINATION
(ELECTRICAL / ELECTRONICS / MECHANICAL / COMPUTER / CHEMICAL /
PETROCHEMICAL ENGINEERING & B. ARCH.)

ENGINEERING MECHANICS

(ME-103)

CREDIT : 04

Maximum Marks : 60

Duration : Three Hours

Note : (i) Answer ALL questions.
(ii) Assume data, if missing.

- 1(a). A transmission tower is held by three guy wires anchored by bolts at B,C,and D. If the tension in wire AB is 2100 N , determine the components of the force exerted by the wire on the bolt at B. (Refer Fig.1) [6]
- 1(b). The shafts of an angle drive are acted upon by the two couples shown. Replace the two couples with a single equivalent couple, specifying its magnitude and the direction of its axis.(Refer Fig.2) [6]

OR

- 1'.(a) The lever BCD is hinged at C and attached to a control rod at B. Determine the maximum force **P** which can be safely applied at D if the maximum allowable value of the reaction at C is 1000 N . (Refer Fig.3) [6]
- 1'.(b) Wire is being drawn at a constant rate from a spool by applying a vertical force **P** to the wire as shown. The spool and the wire wrapped on the spool have a combined weight of 20 N . Knowing that the coefficients of friction at both A and B are $\mu_s = 0.40$ and $\mu_k = 0.30$, determine the required magnitude of the force **P**. (Refer Fig.4) [6]
- 2(a). Determine by integration the centroid of the area shown. Express your answer in terms of a and h . (Refer Fig.5) [5]
- 2(b). Determine the moment of inertia and the radius of gyration of the shaded area shown with respect to the x axis. (Refer Fig.6) [7]

OR

- 2(b'). Derive an expression for the magnitude of the couple **M** required to maintain the equilibrium of the linkage shown. (Refer Fig.7) [7]

Contd.....2

3. Air planes A and B are flying at the same altitude and are tracking the eye of hurricane C. The relative velocity of C with respect to A is $V_{C/A} = 470 \text{ km/h}$ $\swarrow 75^\circ$ and the relative velocity of C with respect to B is $V_{C/B} = 520 \text{ km/h}$ $\swarrow 40^\circ$. Determine: (a) the relative velocity of B with respect to A, (b) the velocity of A if ground based radar indicates that the hurricane is moving at a speed of 48 km/h due north, (c) the change in position of C with respect to B during 15 minute interval (Refer Fig.8) [12]
- 4(a). The acceleration of a package sliding down section AB of incline ABC is 5.49 m/s^2 . Assuming that the coefficient of kinetic friction is the same for each section, determine the acceleration of the package on section BC of the incline. (Refer Fig.9) [6]
- 4(b). A 5 kg collar B can slide without friction along a horizontal rod and is in equilibrium at A when it is pushed 125 mm to the right and released. The undeformed length of each spring is 300 mm and the constant of each spring is $k = 280 \text{ N/m}$. Determine (a) the maximum velocity of the collar (b) the maximum acceleration of the collar. (Refer Fig.10) [6]

OR

- 4(b'). A system consists of three particles A, B, and C. We know that $m_A = 3 \text{ kg}$, $m_B = 4 \text{ kg}$, and $m_C = 5 \text{ kg}$ and that the velocities of the particles expressed in m/s are respectively $V_A = -4 \mathbf{i} + 4 \mathbf{j} + 6 \mathbf{k}$, $V_B = V_x \mathbf{i} + V_y \mathbf{j} + 4 \mathbf{k}$, and $V_C = 2 \mathbf{i} - 6 \mathbf{j} - 4 \mathbf{k}$. Determine (a) the components V_x and V_y of the velocity of particle B for which the angular momentum \mathbf{H}_O of the system about O is parallel to the Z-axis, (b) the corresponding value of \mathbf{H}_O . (Refer Fig.11). [6]

- 5(a). The circular plate shown is initially at rest. Knowing that $r=200\text{mm}$ and that the plate has a constant angular acceleration of 0.3 rad/s^2 , determine the magnitude of the total acceleration of point B when $t=0$ (Refer Fig.12). [6]
- 5(b). The thin plate ABCD of mass 8kg is held in the position shown by the wire BH and two links AE and DF. Neglecting the mass of the links, determine immediately after wire BH has been cut (a) the acceleration of the plate, (b) the force in each link. (Refer Fig.13). [6]

(Fig. Attached)

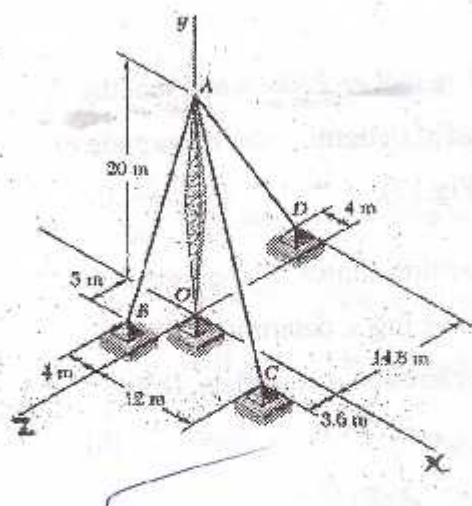


Fig. 1

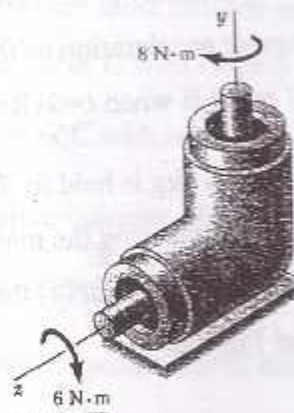


Fig. 2

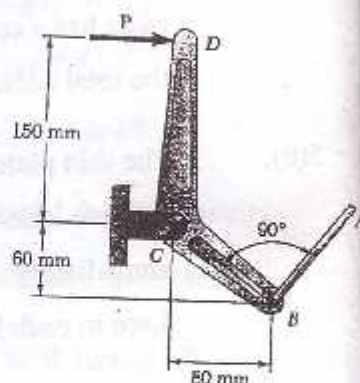


Fig. 3

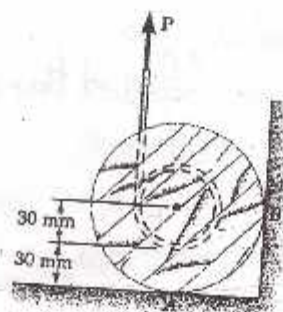


Fig. 4

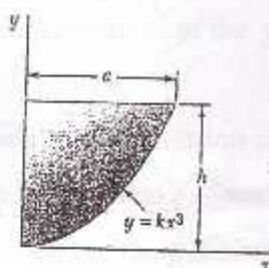


Fig. 5

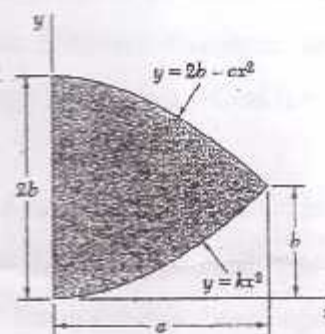


Fig. 6

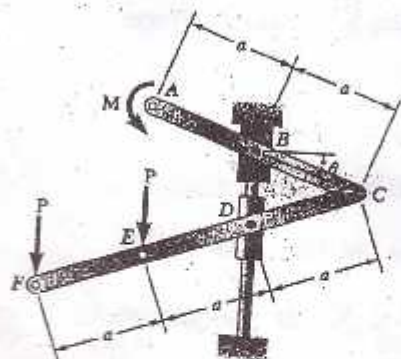


Fig. 7



Fig. 8

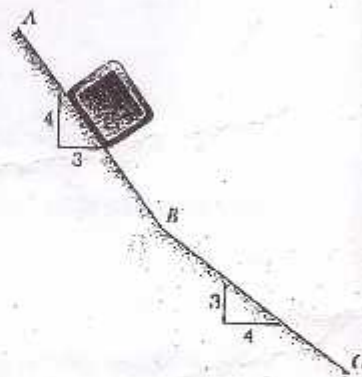


Fig. 9

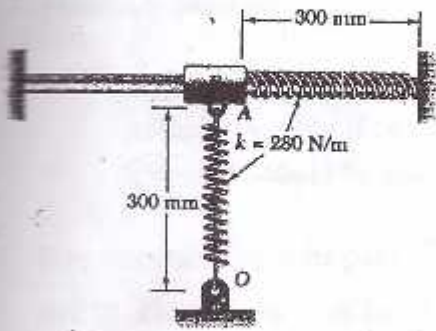


Fig. 10

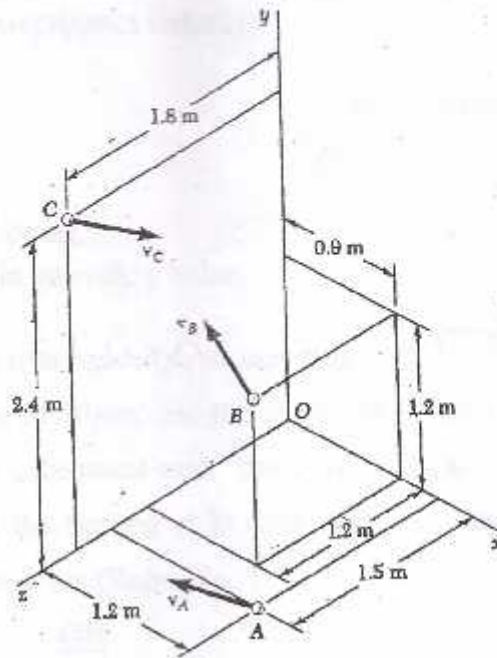


Fig. 11

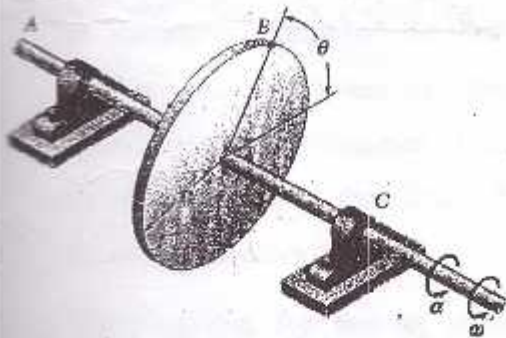


Fig. 12

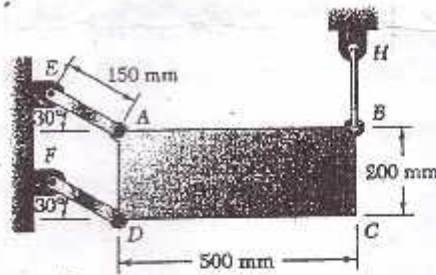


Fig. 13

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B.TECH. AUTMN (I SEMESTER) EXAMINATION
(ELECTRICAL/ELECTRONICS/MECHANICAL/COMPUTER/CHEMICAL/
PETRO-CHEMICAL/B.ARCH/CIVIL ENGINEERING)
APPLIED MECHANICS (ME-111)

Maximum Marks: 60

Duration: Three Hours

Answer **ALL** questions.

Assume suitably if any data missing.

Question should be answered in ascending order.

- 1(a) Two transmission belts pass over sheaves welded to an axle supported by bearings at B and D. The sheave at A has a radius of 50mm, and the sheave at C has a radius of 40mm. Knowing that the system rotates at a constant rate, determine: (a) the tension T, (b) the reactions at B and D. Assume that the bearing at D does not exert any axial thrust and neglect the weights of the sheaves and axle. (Refer Fig. 1) [06]

OR

- 1(a) The elevation of the end of the steel beam supported by a concrete floor is adjusted by means of the steel wedges E and F. The base plate CD has been welded to the lower flange of the beam, and the end reaction of the beam is known to be 100KN. The coefficient of static friction is 0.30 between two steel surfaces and 0.60 between steel and concrete. If the horizontal motion of the beam is prevented by the force Q, determine (a) the force P required to raise the beam (b) the corresponding force Q. (Refer Fig. 2) [06]

- 1(b) Knowing that the line of action of the force Q passes through point C, derive an expression for the magnitude of Q required to maintain equilibrium. (Refer Fig. 3). [06]

- 2(a) A system consists of three particles A, B, and C. We know that $m_A = 3\text{kg}$, $m_B = 4\text{kg}$ and $m_C = 5\text{kg}$ and that the velocities of the particles expressed in m/s are respectively, $\mathbf{V}_A = -4\mathbf{i} + 4\mathbf{j} + 6\mathbf{k}$, $\mathbf{V}_B = -6\mathbf{i} + 8\mathbf{j} + 4\mathbf{k}$ and $\mathbf{V}_C = 2\mathbf{i} - 6\mathbf{j} - 4\mathbf{k}$. Determine the angular momentum \mathbf{H}_O of the system about O. (Refer Fig. 4) [06]

- 2(b) Three spheres, each of mass m, can slide freely on a frictionless, horizontal surface. Spheres A and B are attached to an inextensible, inelastic cord of length l and are at rest in the position shown when sphere B is struck squarely by sphere C which is moving to the right with a velocity \mathbf{V}_O . Knowing that the cord is slack when sphere B is struck by sphere C and assuming perfectly elastic impact between B and C,

determine (a) the velocity of each sphere immediately after the cord becomes taut, (b) the fraction of the initial kinetic energy of the system which is dissipated when the cord becomes taut. (Refer Fig. 5) [06]

OR

- 2' Three small identical spheres A, B, and C, which can slide on a horizontal, frictionless surface, are attached to three 200mm long strings, which are tied to a ring G. Initially the spheres rotate clockwise about the ring with a relative velocity of 0.8m/s and the ring moves along the x-axis with a velocity $V_0 = (0.4\text{m/s}) \mathbf{i}$. Suddenly the ring breaks and the three spheres move freely in the xy plane with A and B following paths parallel to the y axis at a distance $a = 346\text{mm}$ from each other and C following a path parallel to the x axis. Determine (a) the velocity of each sphere, and (b) the distance d. (Refer Fig. 6) [12]
- 3(a) The bent rod ABCDE rotates about a line joining points A and E with a constant angular velocity of 9rad/s . knowing that the rotation is clockwise as viewed from E, determine the velocity and acceleration of corner C. (Refer Fig. 7) [06]
- 3(b) Arm ACB rotates about point C with an angular velocity of 40rad/s counterclockwise. Two friction disks A and B are pinned at their centers to arm ACB as shown in Figure-8. Knowing that the disks roll without slipping at surfaces of contact, determine the angular velocity of (a) disk A, (b) disk B. [06]

OR

- 3(b') In the position shown in Figure-9, bar AB has an angular velocity of 4rad/s clockwise. Determine the angular velocity of bars BD and DE. [06]
4. Determine σ , ϵ , and Δ for each free body diagram and the total structure shown in Figure-10. Take $E = 2 \times 10^5 \text{ N/mm}^2$. [12]

OR

- 4'. Determine $\sum \epsilon_v$ in a cuboid shown in Figure-11. Dimensions along P_1, P_2 , and P_3 are 2m , 1m and 0.5m respectively. $E = 2 \times 10^5 \text{ N/mm}^2$. [12]
- 5(a) Analyse the overhanging beam and draw SFD and BMD. Find the point of contraflexure also. (Refer Fig. 12). [09]
- 5(b) Write the equation of bending and equation of torsion and explain the notations used. [03]

-3-

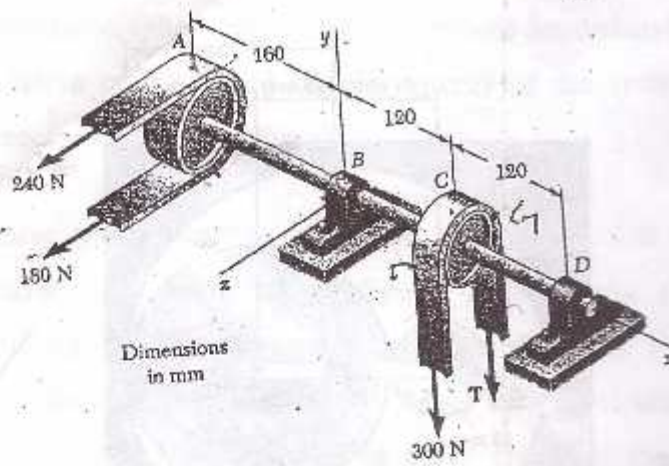


Fig. 1

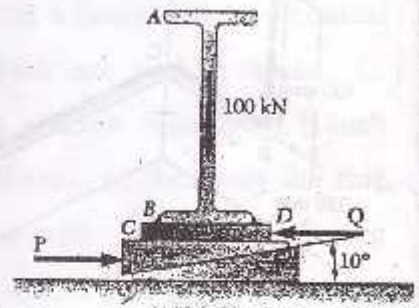


Fig. 2

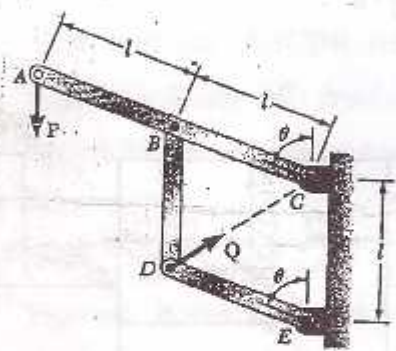


Fig. 3

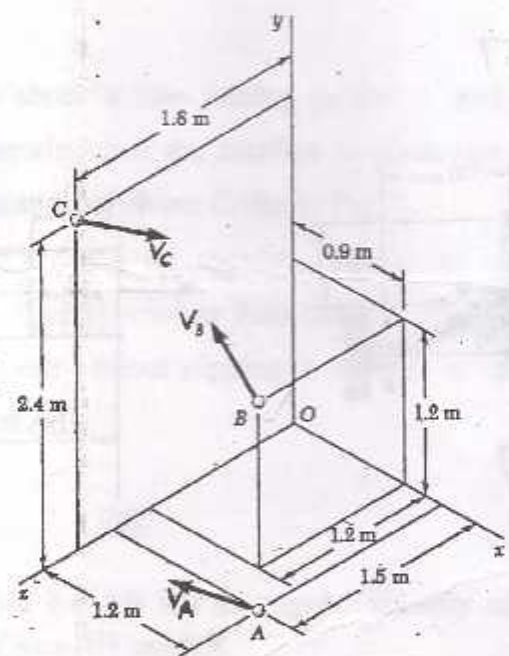


Fig. 4

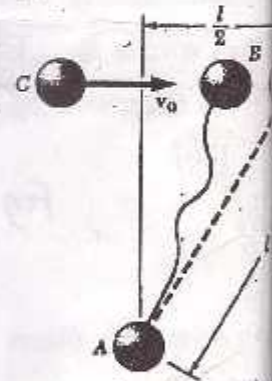


Fig. 5

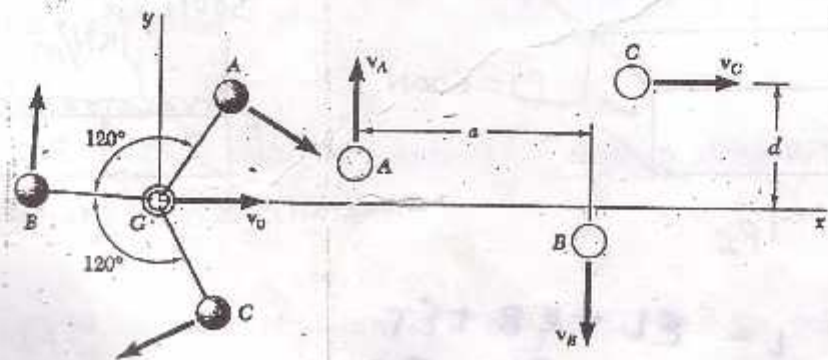


Fig. 6

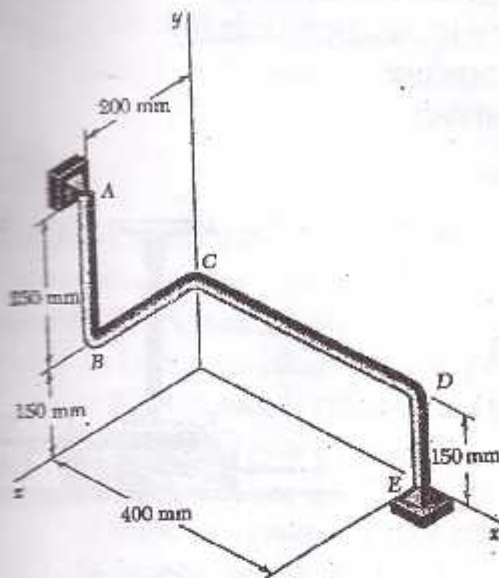


Fig. 7

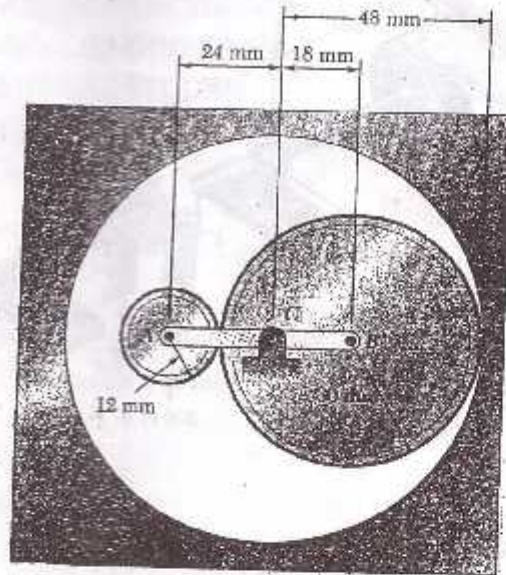


Fig. 8

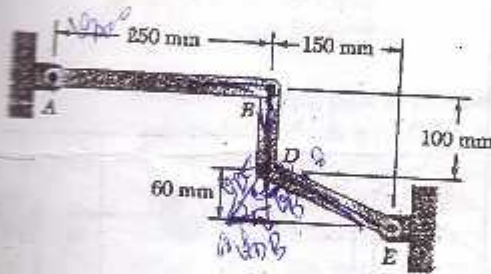


Fig. 9

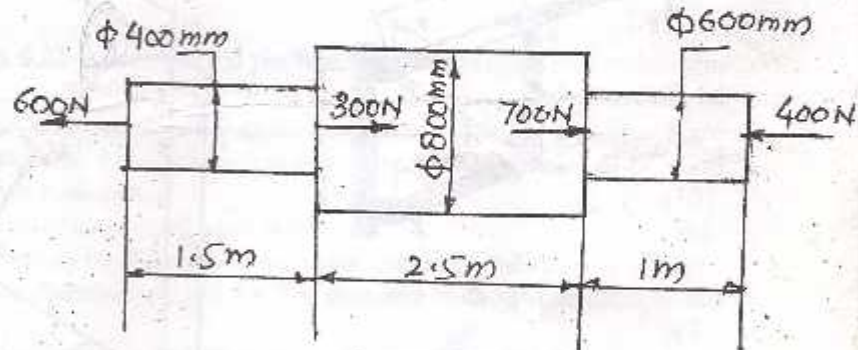


Fig. 10

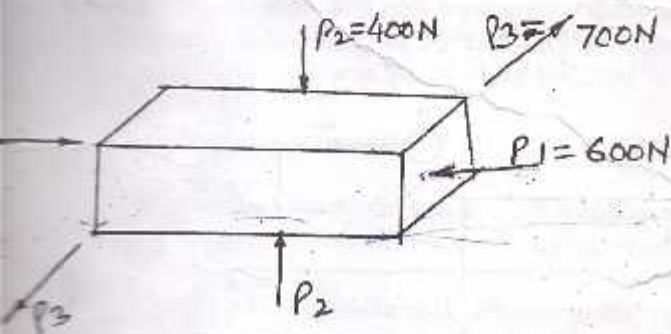


Fig. 11

$$L = \epsilon_L + \epsilon_B + \epsilon_T$$

$$L_F = +\epsilon_L + \frac{1}{m} \epsilon_B + \frac{2}{m} \epsilon_T$$

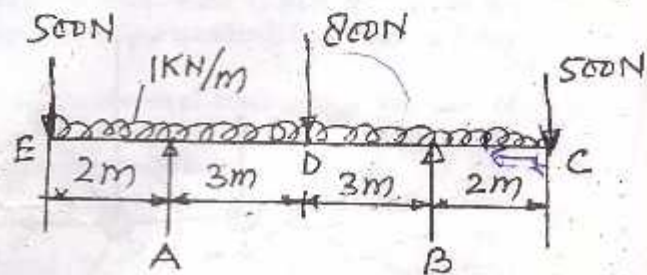


Fig. 12

2013-14

B.TECH. FIRST YEAR (AUTUMN SEMESTER) EXAMINATION
(ELECT./MECH./CIVIL/CHEM./ELECTRONICS/COMPUTER/PETROCHEM. ENGG.)
APPLIED CHEMISTRY I
COURSE CODE AC-101

Maximum Marks: 60

Credits: 03

Duration: Three Hours

Answer all the questions.

Q.No.	Question	M.M.
1(a)	Describe various steps involved in gravimetric analysis.	[04]
(b)	Name different types of titrations with examples. Differentiate between primary and secondary standards.	[06]
OR		
1'(a)	Define and classify Chromatography. Explain any one application of ion-exchange chromatography.	[04]
(b)	Write Beer Lambert's law and explain the terms involved in it. Draw a labelled diagram of a single beam spectrophotometer and discuss the functions of each component.	[06]
2(a)	Classify air pollutants on the basis of origin, chemical composition and state of matter and give their examples.	[05]
(b)	Describe the sources and significance of sulphur dioxide in the atmosphere.	[05]
3(a)	Define heterogeneous system, phase, degree of freedom and component.	[04]
(b)	Draw phase diagram of water system and discuss its important features.	[06]
4(a)	What is natural rubber? How is it obtained from rubber plant?	[05]
(b)	Explain vulcanization of rubber. Describe advantages of vulcanized rubber over natural rubber.	[05]
5(a)	Describe addition and condensation polymerization reactions with examples.	[05]
(b)	Differentiate between thermoplastics and thermosetting plastics.	[05]
6	Write short notes on any <u>two</u> of the followings.	[2×5]
	a) Preparation and properties of polystyrene	
	b) Biodegradable and non-biodegradable organic pollutants	
	c) Invariant reactions	

2013-14

B.TECH. (AUTUMN SEMESTER) EXAMINATION
(Electrical/Mechanical/Chemical/Electronics/Computer/Ptero-Chemical Engineering)
APPLIED CHEMISTRY
(AC-111)

Maximum Marks: 60

Credits: 04

Duration: Three Hours

*Answer all the questions.**Assume suitable data if missing.**Notations used have their usual meaning.*

Q.No.	Question	M.M.
1(a)	Write the significance of von-Weimarn ratio in precipitation and also highlight the favourable conditions for precipitation.	[04]
(b)	Give the principle of volumetric analysis. Describe the various types of titrations with the help of suitable example.	[04]
(c)	Differentiate between primary and secondary standard with the help of suitable examples.	[02]

OR

1'(a)	State and explain the Beer-Lambert Law. Draw a labelled block diagram of Single Beam Spectrophotometer.	[03]
(b)	Distinguish between the followings: i) Adsorption and Partition Chromatography ii) Column and Planer Chromatography	[04]
(c)	A sample on spectrometric analysis showed an absorbance of 5 in a cuvette of path length 2 cm. Calculate the molar absorptivity if the concentration of sample solution is 0.2 g/L and molecular weight of the substance is 150.	[03]
2(a)	Give the steps involved in municipal water treatment. Discuss the significance of sedimentation process.	[04]
(b)	Discuss the caustic embrittlement and methods for its prevention.	[03]
(c)	A sample of water was found to contain the following impurities in mg/L:	[03]

$\text{Ca}(\text{HCO}_3)_2=40.5$; $\text{Mg}(\text{HCO}_3)_2=36.5$; $\text{MgSO}_4=30.0$; $\text{CaSO}_4=6.8$; $\text{NaCl}=10.0$;
 $\text{Fe}_2\text{O}_3=5.0$

Calculate the temporary, permanent and total hardness in degree Clark.

(Atomic Weights: $\text{Ca}=40$, $\text{Mg}=24$, $\text{Cl}=35.5$, $\text{S}=32$, $\text{O}=16$, $\text{C}=12$, $\text{H}=1$, $\text{Na}=23$ and $\text{Fe}=56$)

OR

- 2(a) What are disinfectants? List the various types of disinfectants. Discuss the advantages and disadvantages of bleaching powder as disinfectant. [04]
- (b) Write the chemical reactions involved in determination of hardness causing impurities by Soap and EDTA methods. [02]
- (c) Discuss the advantages and disadvantages of any two of the followings: [04]
 - i) Lime-Soda process
 - ii) Zeolite process
 - iii) Ion Exchange process.
- 3(a) Calculate the minimum amount of air required for the complete combustion of 10 kg of carbon and also find out the composition of flue gases. [03]
- (b) Discuss the advantages and disadvantages of gaseous fuel. Give the composition, calorific value and uses of LPG. [04]
- (c) Describe the Fisher Tropsch process for the production of synthetic petrol. [03]
- 4(a) Enlist the functions of the lubricants. Describe the mechanism of extreme-pressure lubrication. [04]
- (b) What are the various types of greases? Give the conditions of their use. [03]
- (c) Differentiate between the followings: [03]
 - i) Flash and fire points
 - ii) Cloud and setting points
- 5(a) Explain dry corrosion. Discuss the mechanism of oxidation corrosion. [03]
- (b) Discuss the importance of design and material selection in controlling corrosion. [03]

- (c) Write short notes on **any two** of the followings: [04]
- i) Electrode potential
 - ii) Galvanic series
 - iii) Tinning
- 6(a) Explain condensation polymerization with the help of suitable example. [03]
- (b) Discuss briefly the process of vulcanization and its advantages. [04]
- (c) Give the preparation, properties and uses of PE or Bakelite. [03]
-

2013-14

B.TECH./B.ARCH. (AUTUMN SEMESTER) EXAMINATION
(ELECTRICAL/MECHANICAL/CIVIL/ELECTRONICS/COMPUTER/
CHEMICAL/PETRO-CHEMICAL ENGINEERING)
APPLIED MATHEMATICS - I
AM-101

Maximum Marks: 60

Credits: 05

Duration: Three Hours

*Answer all the questions.**Notations used have their usual meaning.*

Q.No.	Question	M.M.
1(a)	For what values of the parameter t , the system of equations	[06]

$$tx + y + z = 1, \quad x + ty + z = 1, \quad x + y + tz = -2$$

fails to have a unique solution? Solve the system, if it is solvable for any of these values of t .

(b)	Find the eigen values and the corresponding eigen vectors of the matrix	[06]
-----	---	------

$$\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}.$$

OR

(b')	Find the characteristic equation of the matrix:	[06]
------	---	------

$$A = \begin{bmatrix} 1 & 3 & 7 \\ 4 & 2 & 3 \\ 1 & 2 & 1 \end{bmatrix}.$$

Show that A satisfies the characteristic equation and hence find the inverse of A .

2(a)	In a parabola $r = \frac{2a}{(1+\cos\theta)}$, prove that	[06]
------	--	------

(i) $\varphi = \frac{\pi}{2} - \frac{\theta}{2}$ and (ii) $p = a \sec \frac{\theta}{2}$.

(b)	Trace the curve $(x^2 - 1)y^2 = x$ by discussing its salient features.	[06]
-----	--	------

OR

Contd.....2

- (b') Show that the asymptotes of the curve

$$(x^2 - y^2)(y^2 - 4x^2) + 6x^3 - 5x^2y - 3xy^2 + 2y^3 - x^2 + 3xy - 1 = 0$$

cut the curve in eight points which lie on the circle $x^2 + y^2 = 1$.

- 3(a) If $y = \frac{\sin^{-1}x}{\sqrt{1-x^2}}$, show that $(1-x^2)y_{n+1} - (2n+1)xy_n - n^2y_{n-1} = 0$. Hence find $(y_{n+1})_0$.

OR

- (a') Expand $x^4 - 3x^3$ in powers of $x - 2$ in Taylor's series.

- (b) (i) Test for convergence the series whose general term is $\sqrt[3]{(n^3 - 1)} - n$.
(ii) Test the convergence of the series

$$x + \frac{3}{5}x^2 + \frac{8}{10}x^3 + \frac{15}{17}x^4 + \dots, \text{ for } x > 0.$$

- 4(a) Show that the intrinsic equation of the parabola $y^2 = 4ax$ is

$$s = a \cot \psi \operatorname{cosec} \psi + a \log(\cot \psi + \operatorname{cosec} \psi).$$

- (b) Find the volume of the spindle shaped solid, generated by revolving the astroid $x^{2/3} + y^{2/3} = a^{2/3}$ about the x-axis.

OR

- (b') The part of the parabola $y^2 = 4ax$ cut off by the latus rectum, revolves about the tangent at vertex. Find the curved surface area of the reel thus generated.

- 5(a) Solve any two of the following differential equations:

(i) $(x^3 e^x - 2y^2)dx + 2xydy = 0$

(ii) $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 5y = e^{2x} \sin x$

(iii) $(x^2 D^2 + 3xD + 5)y = 5(\log x)^2$

- (b) A body executes damped forced vibrations given by the equation:

$$\frac{d^2y}{dx^2} + 2k\frac{dy}{dx} + b^2x = e^{-kt} \sin \omega t.$$

Solve the equation for both cases when $\omega^2 \neq b^2 - k^2$, and when $\omega^2 = b^2 - k^2$.

2013 – 2014
B.TECH. (WINTER SEMESTER) EXAMINATION
ALL BRANCH (BACKLOG)
APPLIED MATHEMATICS – II (OLD COURSE)
(AM – 102)

Credits : 04

Maximum Marks: 60

Duration: Three Hours

Note: Answer all questions.

Use of programmable calculator's is not allowed.

1. (a) Write salient features and trace the conic

$$16x^2 - 24xy + 9y^2 - 104x - 172y + 44 = 0$$

- (b) Find the equation of the cone with vertex at the origin and passing through the curve $x^2 + y^2 = 16, z = 3$.

OR

- (b') If PSP' and QSQ' are two perpendicular focal chords of a conic, prove that [6, 6]

$$\frac{1}{PS \cdot PS'} + \frac{1}{QS \cdot SQ'} \text{ is constant.}$$

2. (a) Show that for the surface

$$x^x y^y z^z = C, \quad \frac{\partial^2 z}{\partial x \partial y} = -(x \log ex)^{-1} \text{ at the point } x = y = z.$$

- (b) If $u = f(x, y)$ and $x = r \cos \theta, y = r \sin \theta$ then,

$$\left(\frac{\partial u}{\partial x}\right)^2 + \left(\frac{\partial u}{\partial y}\right)^2 = \left(\frac{\partial u}{\partial r}\right)^2 + \frac{1}{r^2} \left(\frac{\partial u}{\partial \theta}\right)^2.$$

OR

- (b') If $u = \frac{x+y}{z}, v = \frac{y+z}{x}, w = \frac{y(x+y+z)}{xz}$, show that u, v, w are not [6, 6]
independent and find the relation among them.

3. (a) Obtain Taylor's expansion of the function $f(x, y) = \tan^{-1} \left(\frac{y}{x} \right)$ about $(1, 1)$ upto and including the second degree terms.

- (b) Find the points on the surface $z^2 = xy + 1$ nearest to the origin. [6, 6]

-- 2 --

4. (a) Find the volume of the cylinder $x^2 + y^2 - ax = 0$ bounded by the planes $z = 0$ and $z = x$.
- (b) Evaluate $\iint_R xy \, dx \, dy$, where R is the quadrant of the circle $x^2 + y^2 = a^2$, where $x \geq y \geq 0$.

OR

- (b') Find by double integration the area lying inside the circle $r = a \sin \theta$ and outside the cardioid $r = a(1 - \cos \theta)$. [6, 6]

5. (a) Given that $f(x) = x + x^2$ for $-\pi \leq x \leq \pi$, find Fourier series expansion of $f(x)$ and deduce that $\frac{\pi^2}{6} = 1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2}$.

- (b) Find the half-range cosine series for the function : [6, 6]

$$f(x) = 2x - 1 \text{ for } 0 < x < 1.$$

2013 – 2014

**B. TECH./B. ARCH. AUTUMN (I SEMESTER) EXAMINATION
(ELECTRICAL/MECHANICAL/CIVIL/ELECTRONICS/COMPUTER/
CHEMICAL/PETRO-CHEMICAL ENGINEERING)**

MATHEMATICS - I

(AM-111)

Credits: 04

Max. Marks: 60

Duration: Three Hours

Note: Answer all questions.

Programmable Calculators is not allowed.

1. (a) For what values of λ the following system of linear equations: [5+5+5]
 $x + y + z = 1$, $x + 2y + 4z = \lambda$, $x + 4y + 10z = \lambda^2$ has a solution and solve them if possible.

- (b) Find the eigen values and eigen vectors of the matrix:
$$\begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$$

- (c) Find the characteristic equation of the matrix:

$$A = \begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$$

and hence find the matrix represented by $A^8 - 5A^7 + 7A^6 - 3A^5 + A^4 - 5A^3 + 9A^2 - A + 2I$
 OR

- (c') State Cayley-Hamilton theorem and verify it for the matrix

$$A = \begin{bmatrix} 1 & -2 & 3 \\ 2 & 3 & -1 \\ -3 & 1 & 2 \end{bmatrix} \quad \text{and hence obtain } A^{-1}.$$

2. (a) Trace the curve: [5+5+5]
 $y^2(a+x) = (a-x)x^2$
 by describing the salient features

- (b) If $y = \sin(a \sin^{-1}x)$, Prove that $(1-x^2)y_{n+2} - (2n+1)xy_{n+1} - (n^2-a^2)y_n = 0$

- (c) If $\log y = \tan^{-1}x$, find the coefficient of x^5 in the expansion of y by Maclaurine's series.

3. (a) Find the intrinsic equation of the semicubical parabola $3ay^2 = 2x^3$. [7+8]

- (b) Find the volume of the reel formed by the revolution of the cycloid
 $x = a(\theta + \sin \theta)$, $y = a(1 - \cos \theta)$
 about the tangent at the vertex.

OR

- (b') The part of the parabola cut-off by the latus rectum revolves about the tangent at the vertex. Find the curved surface of the reel thus generated.

Contd...2,

-2-

4. (a) Solve any three of the following:

[9+6]

(i) $\left[y \left(1 + \frac{1}{x} \right) + \cos y \right] dx + [x + \log x - x \sin y] dy = 0$

(ii) $\frac{d^2 y}{dx^2} - 2 \frac{dy}{dx} + 5y = e^{2x} \sin x,$

(iii) $\frac{d^2 y}{dx^2} + 4y = \sin^2 x + x^2 e^x,$

(iv) $x^2 \frac{d^2 y}{dx^2} - x \frac{dy}{dx} - 3y = x^2 \log x.$

- (b) Solve the following system of linear differential equations.

$$\frac{dx}{dt} + 2x + 3y = 0,$$

$$\frac{dy}{dt} + 3x + 2y = 2e^{2t}.$$

OR

- (b') A body falling from rest is subjected to the force of gravity and an air-resistance proportional to the square of the velocity. If the resistance is equal to the weight of the body when the speed is b . Show that the distance traveled by the body in t second is given by

$$\frac{b^2}{g} \log \left(\cosh \frac{gt}{b} \right)$$

2013-2014

B.TECH. AUTUMN (I SEMESTER) EXAMINATION
(ELECTRICAL / MECHANICAL / CIVIL / ELECTRONICS / COMPUTER / CHEMICAL /
PETRO-CHEMICAL ENGINEERING)

MATHEMATICS – II

(AM – 112)

Credits : 04

Maximum Marks: 60

Duration: Three Hours

Note: Answer ALL the questions.

1. (a) If $V = (x^2 + y^2 + z^2)^{-1/2}$, show that :

[5+5+5]

$$\frac{\partial^2 V}{\partial x^2} + \frac{\partial^2 V}{\partial y^2} + \frac{\partial^2 V}{\partial z^2} = 0$$

OR

- (a') If $z(x+y) = x^2 + y^2$, show that :

$$\left(\frac{\partial z}{\partial x} - \frac{\partial z}{\partial y} \right)^2 = 4 \left(1 - \frac{\partial z}{\partial x} - \frac{\partial z}{\partial y} \right)$$

- (b) If $x = r \sin \theta \cos \phi$, $y = r \sin \theta \sin \phi$ and $z = r \cos \theta$, show that :

$$\frac{\partial(x, y, z)}{\partial(r, \theta, \phi)} = r^2 \sin \theta$$

- (c) If $z = f(x, y)$ and $x = e^u + e^{-v}$ and $y = e^{-u} - e^v$, prove that :

$$\frac{\partial z}{\partial u} - \frac{\partial z}{\partial v} = x \frac{\partial z}{\partial x} - y \frac{\partial z}{\partial y}$$

2. (a) Expand $f(x, y) = x^2 y - 3y - 2$ in powers of $(x-1)$ and $(y+2)$ using Taylor's theorem upto second degree terms.

[4+5+6]

- (b) At a distance of 50 meters from the foot of a tower, the elevation of its top is 30° . If the possible error in measuring the distance and the elevation are 2 cm and 0.05 degree respectively, find the approximate error in calculating the height.

OR

- (b') Find the percentage error in the area of a rectangle when an error of +1 percent is made in measuring its length and breadth.
- (c) In a triangle ABC, find the maximum value of $\cos A \cos B \cos C$.

3. (a) Find the volume under the plane $x + y + z = 6$ and above the triangle in the xy-plane bounded by the lines $2x = 3y$, $y = 0$ and $x = 3$.

[5+5+5]

OR

- (a') Evaluate the following integral by changing the order of integration :

$$\int_0^a \int_{\sqrt{ax}}^a \frac{y^2 dy dx}{\sqrt{y^4 - a^2 x^2}}$$

--2--

- (b) Evaluate, by using the transformation $x + y = u$, $y = uv$, the following integral :

$$\int_0^1 \int_0^{(1-x)} e^{\frac{y}{x+y}} dy dx$$

- (c) Find the triple integration the volume cut off from the cylinder $x^2 + y^2 = ax$ by the planes $z = mx$ and $z = nx$.

4. (a) Trace the conic :

[9+6]

$$x^2 + 24xy - 6y^2 + 28x + 36y + 16 = 0$$

Give its salient features.

- (b) If PSP' and QSQ' are two perpendicular focal chords of a conic, prove that

$$\frac{1}{PS \cdot SP'} + \frac{1}{QS \cdot SQ'}$$

is constant.

2013-14

B.TECH. (AUTUMN SEMESTER) EXAMINATION**(Civil/Chemical/ Computer/ Electrical/ Electronics/ Mechanical//Petro-Chemical Engg.)****APPLIED PHYSICS-I****AP-101****Maximum Marks: 60****Credits: 03****Duration: Three Hours***Answer all the questions. Symbols used have their usual meaning.*

1(a) Discuss direct and indirect band gap semiconductors with the help of E vs. k diagrams. [06]
Give four examples of each.

1(b) What do you understand by intrinsic and extrinsic semiconductors? Draw energy bands for n and p-type semiconductors showing donor and acceptor levels. [05]

1(c) Ge is doped with 10^{18} Sb/cm³ at 300 K, where is E_F with respect to E_i ? Also find minority carrier concentration. (Given: $k_B=1.38 \times 10^{-23}$ J/K, $n_i=2.5 \times 10^{13}$ cm⁻³) [04]

OR

1(c') Write down expressions for n_0 and p_0 in terms of n_i . With the help of these expressions explain shifting of Fermi level with the doping concentrations. [04]

2(a) What are the postulates of special relativity? Derive formulae for relativistic length contraction and time dilation by using the Lorentz transformation and inverse Lorentz transformation respectively. [08]

2(b) Define 'Poynting vector' and write down Maxwell's equation for electromagnetic waves. [04]

2(c) An electron with rest mass 0.511 MeV/c² and a photon with zero rest mass have momenta 2.000 MeV/c. Find the total energy of each. [03]

3(a) What do you mean by Compton effect? Obtain the expression for the Compton shift, i.e., $(\lambda' - \lambda) = (h / mc) (1 - \cos \phi)$. Plot the relative intensity versus wavelength graph for different angles of scattering observed in a Compton scattering experiment. [10]

3 b) What is pair production and pair annihilation? Mention essential conditions for pair production to occur. Show that pair production cannot take place in free place. [05]

OR

Contd.....2

-- 2 --

- 3'(a) What is characteristic x-rays? Describe the construction of an x-ray tube and explain [08]
the production mechanism of continuous x-rays. How would you explain the presence
of the minimum wavelength, λ_{\min} in the continuous x-rays spectrum?
- 3'(b) An x-ray photon of initial frequency 1.5×10^{19} Hz emerges from a collision with an [03]
electron with a frequency of 1.2×10^{19} Hz. Find the kinetic energy imparted to the
electron. (take $h = 6.63 \times 10^{-34}$ J.s)
- 3'(c) State Heisenberg uncertainty principle. If uncertainty in the position of a particle is [04]
equal to its de- Broglie wavelength, show that the uncertainty in its velocity is equal its
velocity.
- 4 (a) Discuss the physical significance of a wave function and also mention the [11]
characteristics of a well behaved wave function. Establish the time dependent form of
Schrödinger wave equation and hence obtain its steady state form.
- 4(b) Show that the expectation value, $\langle x \rangle$ of the position of a particle trapped in a box L [04]
wide is $L/2$.

OR

- 4' What is tunnel effect? Obtain an expression for the approximate transmission [15]
probability, T of a particle of energy E incident on a barrier of height U such that $E < U$
-

2013-14

B.TECH. (AUTUMN SEMESTER) EXAMINATION**(Civil/Chemical/ Computer/ Electrical/ Electronics/ Mechanical//Petro-Chemical/Arch. Engg.)****APPLIED PHYSICS****AP-111****Maximum Marks: 60****Credits: 04****Duration: Three Hours**

- Answer all the questions. Symbols used have their usual meaning.
- Some useful physical constants are given at the end of the question paper.

1(a) What is Hall effect? Obtain an expression for majority carrier concentration in terms of measurable parameters. Mention two important applications of Hall effect. [7.0]

OR

1(a') Starting with Fermi-Dirac distribution function and density of states in conduction band, derive an expression for equilibrium concentration of electrons (n_0). Also explain shifting of Fermi level with doping concentrations. [7.0]

1(b) Discuss Meissner effect with the help of suitable diagram. What are type-I and type-II superconductors? Why type-I superconductor is not useful for making electromagnet? [5.0]

1(c) A Si sample is doped with $5 \times 10^{17} \text{ cm}^{-3}$ donors and $2 \times 10^{17} \text{ cm}^{-3}$ acceptors. Find the position of the Fermi level with respect to E_i at 300 K. [3.0]

2(a) Describe construction and working of He-Ne laser with the help of suitable diagrams. Mention one of the drawbacks of ruby laser. [6.0]

OR

2(a') What are the important characteristics of a laser? Discuss working principle of ammonia maser and its one important application. [06]

2(b) What is basic principle of e.m. wave propagation in an optical fiber? Obtain an expression for angle of acceptance in a step index optical fiber in terms of core and cladding refractive indices. [5.5]

2(c) A ruby laser emits 1.0 J pulses of light whose wavelength is 694.3 nm. What is the minimum number of Cr^{3+} ions in the ruby? [3.5]

3(a) Explain Compton effect and deduce an expression for the change in wavelength of a [7.0]

Contd.....2

photon scattered through an angle Φ by a particle of rest mass m_0 .

Determine the energy of a photon if it is to have the momentum of a 10 MeV proton.

- 3(b) Define phase and group velocities. The phase velocity of ocean waves is $\sqrt{g\lambda/2\pi}$, [3.0]
where g is the acceleration due to gravity. Find the group velocity of ocean waves.
- 3(c) Write down the time dependent form of the Schrödinger equation and hence obtain [5.0]
its steady state form.
Show that expectation value of the position of a particle trapped in a box L wide is $L/2$.
- 4(a) Derive the expression for the molecular energy distribution for ideal gas molecules [5.0]
with energies between ϵ and $\epsilon + d\epsilon$ in a sample of the gas that contains N molecules
at absolute temperature T .
- 4(b) Write statistical distribution functions for classical and quantum mechanical [3.0]
particles.
Show that probability of occupancy of a quantum state by two bosons to be in the
same state is twice that for two classical particles whereas it is zero for two
fermions.
- 4(c) Define Q value and threshold energy of a nuclear reaction and obtain a [3.5]
mathematical relationship between these physical quantities for an endothermic
nuclear reaction.
- 4(d) Draw a neat and labelled diagram of a gas filled detector and explain its working in [3.5]
different regions of operation.

Some useful physical constants

$$\begin{aligned} h &= 6.63 \times 10^{-34} \text{ J.s,} & k_B &= 1.38 \times 10^{-23} \text{ J/K,} \\ m_e &= 9.1 \times 10^{-31} \text{ kg,} & m_p &= 1.67 \times 10^{-27} \text{ kg,} & c &= 3 \times 10^8 \text{ m/s} \\ n_i(\text{Si}) &= 1.5 \times 10^{16} \text{ m}^{-3} & q_e &= 1.6 \times 10^{-19} \text{ C} \end{aligned}$$

2013-14
B.ARCH. (VI SEMESTER) EXAMINATION
AR 103, Architectural Drawing -I
Credits: 4

Duration: 3 Hours

Maximum Marks: 40

Answer all the questions.

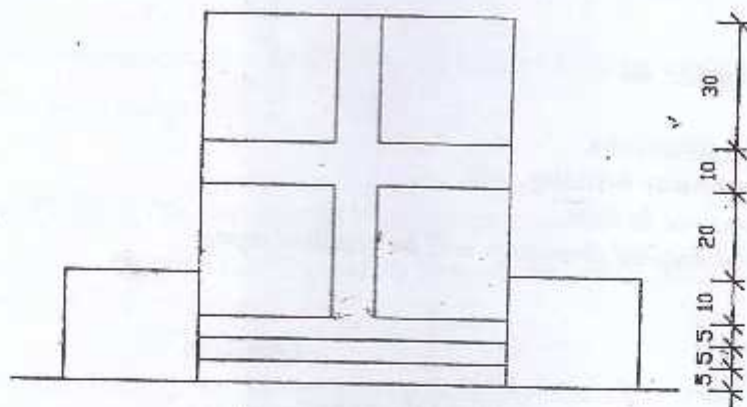
Suitable assume any missing data.

All dimensions are in mm.

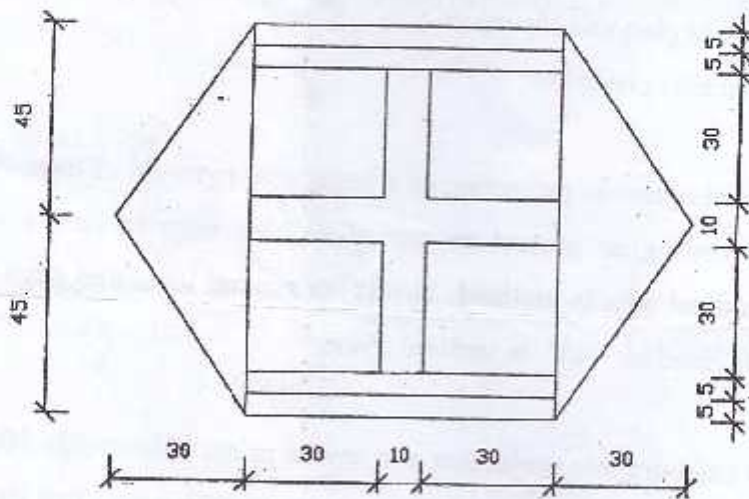
Neat and good drafted drawings will be credited more.

Q.No.	Question	M.M.
1	Represent any two of the followings:- a) Brick work (in box size 50 mm X 80 mm) b) Plants in plan and elevation c) Car in side elevation	5+5
2	Draw orthographic projection of a hexagonal pyramid of base side 30mm & height 60mm resting on ground on one of its base edge in such a way that its central longitudinal axis is inclined at $<45^{\circ}$ to ground level and edge touching ground is also inclined at $<45^{\circ}$ to vertical plane.	10
OR		
2*	Draw orthographic projection of a square prism of base side 30mm & height 60mm resting on ground on one of its base edge in such a way that its central longitudinal axis is inclined at $<60^{\circ}$ to ground level and edge touching ground is inclined at $<45^{\circ}$ to vertical plane.	10
3	Draw surface development of a sphere of diameter 60mm.	10
4	Draw isometric view of the object shown in Figure -1	10

Contd.....2



ELEVATION



PLAN

FIGURE - 1
(All dimensions are in mm)

2013-2014

**B.Arch./B.TECH.(ALL BRANCHES) (AUTUMN SEMESTER) EXAMINATION
STRENGTH OF MATERIALS
(CE-101)**

Maximum Marks:60

Credits:04

Duration: Three Hours

Note: (i) Answer all the questions.
(ii) Assume suitable data, if not given.

Q1(a). Briefly explain the following terms:

(04)

- (i) Principle of superposition
- (ii) Strain hardening

Q1(b). A steel rod of 20mm diameter passes centrally through a copper tube of 50mm external diameter and 40mm internal diameter. The tube is closed at each end by rigid plates of negligible thickness. The nuts are tightened on the projecting parts of the rod. If the temperature of the assembly is raised by 50°C , calculate the stresses developed in copper and steel. Take E for steel and copper as 200GN/m^2 and 100GN/m^2 and coefficient of thermal expansion for steel as 12×10^{-6} per $^{\circ}\text{C}$ and for copper as 18×10^{-6} per $^{\circ}\text{C}$. (08)

OR

Q1'(a). Define Poisson's ratio. A bar of 20mm diameter is subjected to a pull of 50KN which causes stress within elastic limit. The measured extension on a gauge length of 200mm is 0.1mm and the change in diameter is 0.0035mm. Calculate the Poisson's Ratio, Modulus of Elasticity, Bulk Modulus and Modulus of Rigidity. (04)

Q1'(b) A steel bar 25mm diameter is loaded as shown in Fig.1. Determine the stresses in each part and the total elongation. Take $E = 210 \text{ GPa}$. (08)

Q2. The state of stress at a point in a stressed material is given by $\sigma_x = 20\text{MPa}$, $\sigma_y = 10 \text{ MPa}$ and $\tau_{xy} = 25\text{MPa}$. Determine the direction and magnitude of the principal stresses in the material. Also, locate the planes of maximum shearing stress and calculate the normal and shearing stresses on these planes. (12)

OR

Q2'. In a certain material under load plane AB carries a tensile direct stress of 30MPa and a shear stress of 20MPa, while another plane BC carries a tensile direct stress of 20MPa and a shear stress. If the planes are inclined to one another at 30° and plane AC at right angles to plane AB carries a direct stress unknown in magnitude and nature (shown in Fig.2), find (a) the value of the shear stress on BC, (b) the magnitude and nature of the direct stress on AC, and (c) the principal stresses. (12)

Contd.....2

Q3. For the beam shown in Fig.3, draw the shear force and bending moment diagrams indicating the values at critical points. Also locate the point of contra flexure, if any. (12)

Q4(a). Enumerate the assumptions made in simple theory of bending. (03)

Q4(b). A beam of I-section 50cm deep and 20cm wide, has equal flanges 2cm thick and web 1cm thick. It carries at a cross-section a shear force of 200kN. Determine the shear stress distribution in the beam and the ratio of maximum shear to mean shear. (09)

OR

Q4'. Prove that for a solid circular section of diameter D (radius r), the shear stress at a distance of y from neutral axis is (12)

$$q = \frac{F}{3I} (r^2 - y^2)$$

where, F is the shear force at the section and I is the moment of inertia of cross-section.

Q5. A solid aluminium shaft 100cm long and of 5cm diameter is to be replaced by a tubular steel shaft of the same length and the same outside diameter, so that either shaft could carry the same torque and have the same angle of twist over the total length. What must be the inner diameter of the tubular steel shaft? Modulus of rigidity of steel may be taken as 85GPa and that of Aluminium as 28GPa. (12)

FIGURES

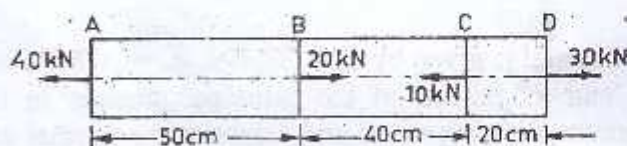


Fig.1

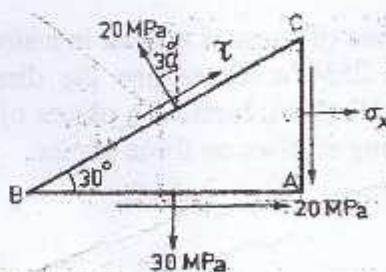


Fig.2

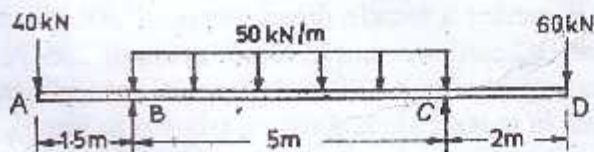


Fig.3

2013-14
B.TECH. (AUTUMN SEMESTER) EXAMINATION
ELECTRONICS/COMPUTERS/ELECTRICAL/MECHANICAL/CIVIL/CHEMICAL/
PETROCHEMICAL/B. Arch
ENVIRONMENTAL STUDIES
CE111

Maximum Marks: 60

Credits: 04

Duration: Three Hours

Answer all the questions.

Assume suitable data if missing.

Notations used have their usual meaning.

Q.No.	Question	M.M.
1(a)	Draw the flow diagram of energy cycle and discuss the flow of energy in an ecosystem.	[05]
OR		
1(a)	Draw a flow diagram of carbon cycle and discuss the cycle in brief.	[05]
1(b)	Enlist the various segments of the environment and discuss any one in detail.	[05]
2(a)	What are the sources of carbon monoxide and its effect on human health?	[05]
2(b)	Write short notes on any three of the following	[05]
	(i) Photochemical smog	
	(ii) Ozone Depletion	
	(iii) Biochemical Oxygen Demand	
	(iv) Gaseous analysis of SO ₂	
3(a)	Describe briefly about the coagulation and flocculation process in water treatment.	[05]
3(b)	Design a sedimentation tank for a population of 10 thousand persons using 150 litres per day per person.	[05]
4(a)	A mixture of domestic wastewater and river water has a 5 day, 20°C BOD of 15 mg/l. rate constant equal to 0.23/d. What will be its 3 day, 27°C BOD? Using Streeter – Phelps equation plot the curve for DO concentration in the stream vs. time of travel in days. Assume: stream temperature 20°C, stream reaeration rate constant as 0.6/d, saturation DO as 8.0 mg/L and initial deficit as 2.0 mg/L.	[06]

-- 2 --

- 4(b) What are low cost wastewater treatment systems? [04]
- 5 (a) Define lapse rate and discuss their relationship with atmospheric stability. [05]
- 5(b) Classify the particulate air pollutants. [05]

OR

- 5'(b) Describe the working principle of centrifugal collector. [05]
- 6(a) Describe the different functional elements of solid waste management. [05]

OR

- 6'(a) How hazardous waste is classified? What are the different techniques adopted to manage hazardous waste? [05]
- 6(b) Describe various disposal techniques for municipal solid waste and explain any one of them in detail. [05]
-

2013-14
B.TECH. (AUTUMN SEMESTER) EXAMINATION
ELECTRICAL ENGINEERING
BASIC ELECTRICAL ENGINEERING
EE-101

Maximum Marks: 60

Credits: 04

Duration: Three Hours

Answer all the questions.

Assume suitable data if missing.

Notations used have their usual meaning.

1(a) A circuit consists of three branches connected in parallel across a 240V, 50 Hz supply. Branch 1 consists of 8 ohm resistor in series with a 200 μ F capacitor, branch 2 consists of an inductor of 4 Ω resistance and 20 mH inductance and branch 3 is a 10 Ω resistor. Calculate, [08]

- 1) The current in each branch.
- 2) The total current taken from the supply.
- 3) The overall power factor.

1(b) State Norton's theorem and Thevenin's theorem as applicable to a.c. circuit. [04]

OR

1(a) In the circuit of figure 1, determine the current through Z_L using, [07]

- 1) Thevenin's theorem.
- 2) Norton's theorem.

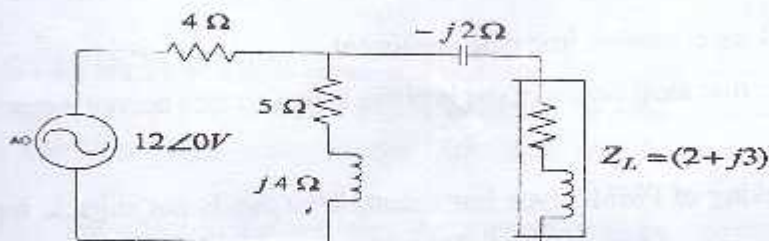


Figure 1

Contd.....2

- 1' (b) Derive an expression that relates line and phase voltages for star connected load. [05]
- 2(a) An iron magnetic circuit has a uniform cross sectional area of 5 cm^2 and a length of 25 cm. A coil of 120 turns is wound uniformly over the magnetic circuit. When the current in the coil is 1.5 A, the total flux is 0.3 mWb. For each value of current, calculate, [06]
- 1) The magnetizing force.
 - 2) The relative permeability of the iron.
- 2(b) A 40 kVA single phase transformer has iron losses of 800 W and copper losses of 1140 W when supplying its full load at unity power factor. Calculate the efficiency of the transformer at unity power factor at, [06]
- 1) Full load
 - 2) Half load
- 3(a) Define synchronous speed. A 6 pole alternator rotates at 1000 r.p.m. What is the frequency of the generated voltage? [04]
- 3(b) Using suitable derivation explain how rotating magnetic field is produced in a three phase induction motor. [08]

OR

- 3' (a) Explain why single phase induction motor is not self starting? [05]
- 3' (b) Explain various methods to make the single phase induction motor self starting. [07]
- 4(a) Explain the working of moving iron type instrument. [06]
- 4(b) Describe the constructional details of single phase induction type energy meter. [06]
- OR
- 4' (a) Explain the working of PMMC type instrument. Why this is not suitable for AC measurement? [08]
- 4' (b) Define in reference to measuring instrument, [04]
- 1) Deflecting torque
 - 2) Damping torque
- 5(a) Draw the layout of a power system indicating various voltage levels. [05]
- 5(b) With the help of a suitable diagram explain the working of Nuclear power plant. [07]
-

2013-14

B.TECH/B.ARCH (AUTUMN SEMESTER) EXAMINATION
(Civil/Electrical/Electronics/Computer/Mechanical/Petrochemical/Chemical)
Basics of Electrical & Electronics Engineering
EE-111 (Part A & Part B)

Maximum Marks: 60

Credits: 04

Duration: Three Hours

Answer all the questions.

Assume suitable data if missing.

Notations used have their usual meaning.

Part A(Q1&2) and Part B(Q3&4) are to be answered in separate copies.

PART A (To be answered in a separate copy)

- 1(a) For figure 1 given below, find the current through AB using superposition theorem. [05]

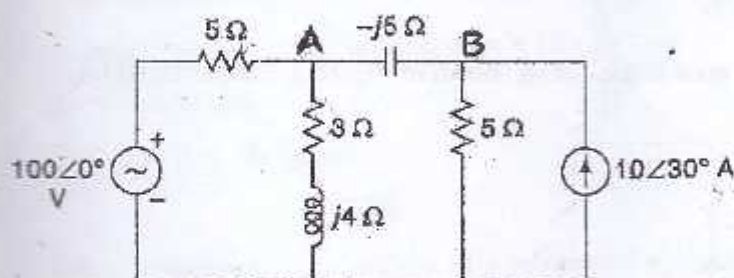


Figure 1

- 1(b) An iron ring of 100 cm mean circumference is made from round iron of cross-section 10 cm^2 . Its relative permeability is 500. If a saw-cut 2 mm wide is made on it, determine the current required to produce a flux of 0.0012 Wb in the air gap. The number of turns is 200. [05]
- 1(c) What are different types of magnetic losses? How can they be minimized? [05]

OR

- 1(a) The load in each branch of a delta connected balanced three phase circuit consists of an inductance of 0.0318 H in series with a resistance of 10Ω . The balanced line voltage is 400 V at 50 Hz. Calculate the line current and the total power in the circuit. [05]
- 1(b) Explain how the effect of leakage flux in a transformer be represented by an equivalent leakage reactance. State the condition for maximum efficiency of a transformer. [05]
- 1(c) A 500 kVA single phase, 2000/200 V, 50 Hz transformer has a high voltage winding resistance of 0.2Ω and a leakage reactance of 0.4Ω . The low voltage winding resistance is 0.002Ω and the leakage reactance 0.008Ω . Find the equivalent winding impedance referred to the high voltage side and the low voltage side. [05]
- 2(a) Why is a single phase induction motor non self starting? Discuss working of a capacitor start capacitor run type single phase induction motor. [05]

Contd.....2

- 2(b) With the help of a figure explain how power is measured using an electro-dynamometer type wattmeter. [05]

- 2(c) How are hydroelectric power plants classified? With the help of a figure explain a pumped storage hydroelectric power plant. [05]

PART B (To be answered in a separate copy)

- 3(a) What are logic gates? Give circuit realization and truth table of OR, AND, NOT NOR and NAND gates. [07]

OR

- 3(a') With the help of a neat diagram, explain the operation of a Bridge Rectifier. What is PIV for the diode used here. [07]

- 3(b) Si-transistor with $\beta = 50$ is used in the circuit shown in Figure 2, determine (i) I_{CQ} (ii) V_{CEQ} (iii) I_{Csat} (iv) I_{BQ} [08]

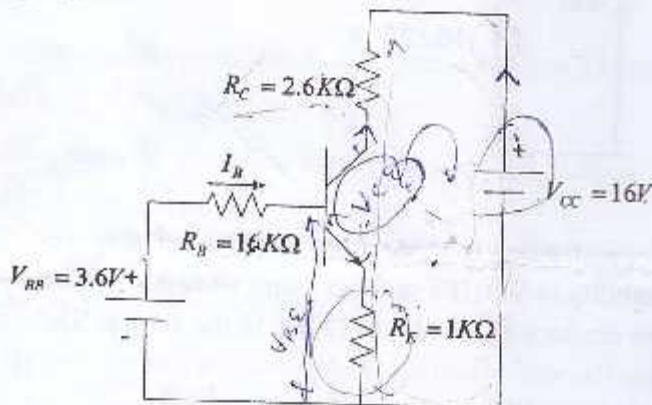


Figure 2

- 4(a) Explain the construction, working and characteristics of depletion mode MOSFET. Also explain the difference between enhancement and depletion MOSFET. [07]

OR

- 4(a') What are different characteristics of an ideal operational amplifier? Also explain the significance of virtual ground in an operational amplifier? [07]

- 4(b) Design an operational amplifier circuit that will produce the output voltage $V_o = 0.5V_1 - 2V_2$. [08]

XXXXXXXXXXXX

XXXXXXXXXXXX

2013 – 2014

**B.ARCH. / B.TECH. AUTUMN (I SEMESTER) EXAMINATION
(ELECT. / MECH. / CIVIL / CHEM. / ELECTRONICS / COMPUTER /
PETRO-CHEMICAL ENGINEERING)**

**ENGLISH
(EN – 101)**

Credits : 04

Maximum Marks: 60

Duration: Three Hours

Note: Answer all questions.UNIT – I

1. (a) Read the passage and answer the questions that follow: [5×2=10]

Unlike the scientist, the engineer is not free to select the problem which interests him, he must solve the problems as they arise, and his solutions must satisfy conflicting requirements. Efficiency costs money, safety adds complexity, performance increases weight. The engineering solution is the optimum solution, the most desirable end result taking into account many factors. It may be the cheapest for a given performance, the most reliable for a given weight, the simplest for a given safety, or the most efficient for a given cost. Engineering is optimizing.

To the engineer, efficiency means output divided by input. His job is to secure a maximum output for a given input or to secure a given output with a minimum input. The ratio may be expressed in terms of energy, materials, money, time or men. Most commonly the denominator is money, in fact, most engineering problems are answered ultimately in dollars and cents. Efficient conversion is accomplished by using efficient methods, devices and personnel organizations.

The emphasis on efficiency leads to the large, complex operations which are characteristics of engineering. The processing of the new antibiotics and vaccines in the test-tube stage belongs in the field of biochemistry, but when great quantities must be produced at low cost, it becomes an engineering problem. It is the desire for efficiency and economy that differentiates ceramic engineering from the work of the potter, textile engineering from weaving, and agricultural engineering from farming.

- (i) Identify the disciplines being compared in the passage.
- (ii) What is meant by the expression 'Engineering is optimizing'.
- (iii) What is the rationale for efficiency?
- (iv) Discuss how engineering problems arise.
- (v) Make the following words negative – efficient, interest.

- (b) Write a summary of the passage given above.

[10]

Contd.....2

UNIT - II

2. (a) Elaborate in your works, The Time Traveller's journey to the year 802701 AD. [05]

OR

- (a') Discuss the world of the Marlocks.

2. (b) Discuss the 'Battle of the Windmill'. [05]

OR

- (b') Describe Old Major's dream.

UNIT - III

3. Write the process of booking/purchasing an airline ticket via internet. [10]

OR

- 3'. Write a report on your experience of the Ist Semester that you are completing at Zakir Husain College of Engineering and Technology, A.M.U.

UNIT - IV

4. Read the following passage carefully and write a précis of the passage. [05]

A degree never came with the promise of a job. Now a study shows that 47% of graduates are not employable in any sector. Their poor English and cognitive skills are to be blamed. While one of two pass-outs will easily show off their theoretical skills, the number falls to just a quarter when knowledge must be applied.

In case of computer science/IT, 30% engineers do not know basic theoretical concepts used in computer programming, according to the latest Computer Programming Learning Levels, Engineering Graduates, 2013 report. The pan-India study examines the capability of engineering students in computer programming at the end of their undergraduate education. "Computer programming skill is the key foundational skill required by the IT industry and also covered by aca-

demic curriculum. Yet, we find only 14.97% of IT specialization students can write a simple program, while 70% of them show theoretical understanding. Clearly, the problem is rote learning. This needs to be fixed," said Varun Agarwal, co-Founder and CTO, of the company that carried out the study.

The Computer Programming Learning Levels, Engineering Graduates- Annual Report, 2013 draws inference from data from more than 55000 engineering students across India from over 250 engineering colleges.

Since the advent of the software industry in India,

there has been a constant requirement of sector specific talent for the IT industry. Computer programming and algorithm design are the most common denominators required vitally amongst IT professionals. However, 50% to 60% of CS/IT engineers do not understand subtleties of programming concepts, while more than 80% are unable to apply them to real-world situations. Only 14.97% of the engineers are able to do application of programming constructs, which are of routine use in the industry, the study noted.

"When we look at advanced areas of programming like algorithm design such as complexity theory, around 50% CS/IT engineering students do not know basic terminologies and definitions in these areas. In terms of complexity theory and application based knowledge of CS/IT engineering students, the percentage drops to a dismal 13.05," the report said.

UNIT - V

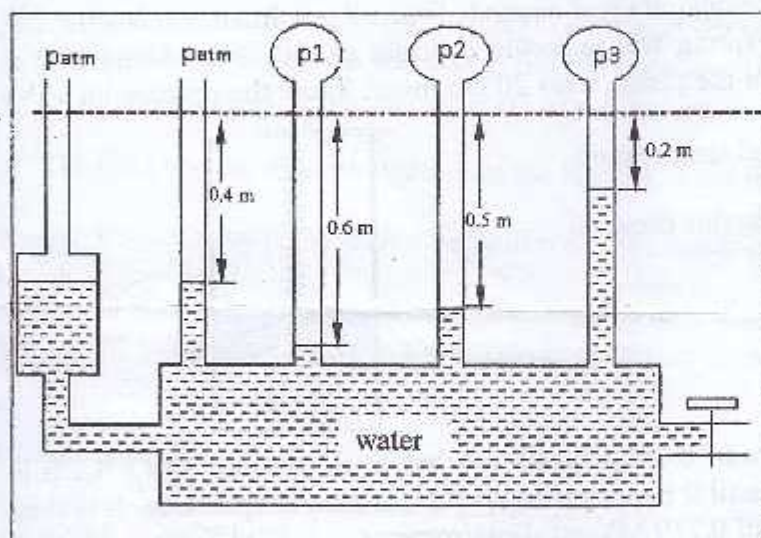
5. (a) Complete the following by choosing the appropriate words from the given list: [05]
- The researcher in the field of economics who investigates the phenomenon of _____, which leads emerging countries to rely almost exclusively on the export of raw materials for their foreign _____, often finds that for this reason and also to satisfy the growing demands caused by _____, both the _____ of crops and breeders of animals tend to over _____ the land.
- [exchange, over population, industrialization, cultivators, cultivate]
- (b) Write an essay on any ONE of the following topics in about 400 words: [10]
- (i) Technology and adolescent trends.
 - (ii) My favorite sport.
-

2013-14

**B.TECH. (AUTUMN SEMESTER) EXAMINATION
CIVIL/CHEMICAL/COMPUTERS/ELECTRICAL/ELECTRONICS/
MECHANICAL/PETRO-CHEMICAL
THERMAL SCIENCES
ME101**

Maximum Marks: 60**Credits: 04****Duration: Three Hours***Answer all the questions.**Assume suitable data if missing.**Notations used have their usual meaning.**Use of Steam Tables is permissible.*

Q.No.	Question	M.M.
1(a)	Find pressures (absolute) p_1 , p_2 and p_3 if $p_{atm} = 740$ mm of Hg in the figure given below.	[07]



- 1(b) For a system to be in thermodynamic equilibrium, do the temperature and pressure have to be the same everywhere? [02]
- 1(c) What are the different types of systems? Give an example for each type. [03]
- 2(a) Apply SFEE to adiabatic nozzle and hence define stagnation enthalpy. [04]

Contd.....2

- 2(b) A gas flows steadily through a rotary compressor. The gas enters the compressor at a temperature of 16°C , a pressure of $100 \times 10^3 \text{ N/m}^2$ and an enthalpy of $391.2 \times 10^3 \text{ J/kg}$. The gas leaves the compressor at a temperature of 245°C , a pressure of $600 \times 10^3 \text{ N/m}^2$ and an enthalpy of $534.5 \times 10^3 \text{ J/kg}$. There is no net heat transfer to or from the gas as it flows through the compressor. [08]

(i) Evaluate the external work done per unit mass of gas assuming the gas velocities at entry and exit to be negligible.

(ii) Evaluate the external work done per unit mass of gas when the gas velocity at entry is 80 m/s and that at exit is 160 m/s .

OR

- 2'(a) With the help of sketches, precisely describe the working of a 4-stroke IC engine. [06]

- 2'(b) A piston-cylinder device shown in the figure contains 50 kg of water at 250 kPa and 25°C . The cross-sectional area of the piston is 0.1 m^2 . Heat is now transferred to the water, causing part of it to evaporate and expand. When the volume reaches 0.2 m^3 , the piston reaches a linear spring whose spring constant is 100 kN/m . More heat is transferred to the water until the piston rises 20 cm more. Show the process on a P-v diagram and determine [06]

(i) The final pressure and temperature

(ii) The work done during this process.



- 3 A refrigerant is at a pressure of 0.745 MN/m^2 and has a temperature of 45°C . It is cooled at constant pressure until it becomes liquid at saturation temperature. It is then throttled down to a pressure of 0.219 MN/m^2 . Determine [12]
- (i) the heat transfer during the constant pressure cooling process per kilogram of refrigerant
- (ii) the quality of the refrigerant after throttling

Use the data given below:

Pressure MN/m^2	Saturation temperature $^\circ\text{C}$	Specific enthalpy (kJ/kg)		
		h_f	h_{fg}	Superheated by 20 K
0.219	-10	26.9	183.2	195.7
0.745	30	64.6	199.6	214.3

OR

3'(a) Draw $p-v$ diagram for a pure substance that contracts on freezing (normal behaviour), marking clearly all salient points and boundaries. [06]

3'(b) The properties of a certain fluid are related as follows [06]

$$u = 196 + 0.718 T$$

$$pv = 0.287 (T + 273)$$

where u is the specific internal energy (kJ/kg), T is in $^{\circ}\text{C}$, p is pressure (kN/m 2) and v is specific volume (m 3 /kg). For this fluid, find C_v and C_p .

4 A vapour-compression refrigerator uses methyl-chloride as the working fluid. The fluid flows steadily into the compressor at a pressure of $119 \times 10^3 \text{ N/m}^2$ and is delivered to the condenser as dry saturated vapour at a pressure of $653 \times 10^3 \text{ N/m}^2$. The fluid leaves the condenser as saturated liquid at a pressure of $653 \times 10^3 \text{ N/m}^2$ and after expansion in the throttle valve to pressure of $119 \times 10^3 \text{ N/m}^2$, it flows through the evaporator and thence back into the compressor again. The compression process may be assumed to be reversible and adiabatic and the throttling process to be adiabatic. Changes in kinetic energy and in elevation are negligible. [12]

(a) Evaluate the dryness fraction of the fluid entering the compressor and hence the shaft work done per unit mass of refrigerant.

(b) Evaluate the dryness fraction of the fluid after the throttling process.

(c) Evaluate the heat transfer per unit mass to the refrigerant in the evaporator.

(d) Evaluate the coefficient of performance of the refrigerator and compare it with the value for a reversed Carnot cycle operating between the given temperature limits.

Use the data for methyl-chloride given below:

Pressure N/m 2	Saturation temperature $^{\circ}\text{C}$	Specific enthalpy kJ/kg		Specific entropy kJ/kg-K	
		Saturated liquid	Saturated vapour	Saturated liquid	Saturated vapour
119×10^3	-20	30.1	455.2	0.124	1.803
653×10^3	30	108.6	478.7	0.406	1.627

OR

- 4'(a) Establish the relation $S_2 - S_1 = \int_1^2 \left(\frac{dQ}{T} \right)$ and hence deduce the principle of increase of entropy. [06]
- 4'(b) Prove that a PMM2 does not exist. [06]
- 5(a) A composite wall is made up of an external surface of brick 110 mm thick, inside which is a layer of fibreglass 75 mm thick. The fibreglass is faced internally by an insulating board 25 mm thick. The thermal conductivities for the three materials are 0.6 (brick), 0.04 (fibreglass) and 0.06 (insulating board) W/m-K. The inside and outside air heat transfer coefficients are 2.5 W/m²-K and 3.1 W/m²-K. Determine the heat lost per hour through such a wall which is 6 m high and 10 m long. Take the internal and external ambient temperatures as 27 °C and 10 °C respectively. [08]
- 5(b) Define, absorptivity, emissivity, grey body and Kirchoff's identity. [04]
-

2013-14
B.TECH. (I SEMESTER) EXAMINATION
MECHANICAL
ENGINEERING GRAPHICS
ME-102

Maximum Marks: 40

Credits: 04

Duration: Three Hours

Answer all the questions.

Assume suitable dimension, if missing.

Notations used have their usual meaning.

- | Q.No. | Question | M.M. |
|-------|---|------|
| 1 | Construct a diagonal scale to measure kilometres, hectometres and decametres to a scale 1:50000 and measure on it a length of 9 kilometres, 6 hectometres and 5 decametres. | [10] |
| 2 | The plan of a line CD is 35mm long and inclined at 30° to the V.P. The line is 50mm long. The end C is 10mm above of H.P. and 15mm in front of V.P. Draw the projections of the line. Find its true inclination with the V.P., H.P. and P.P. | [10] |
| OR | | |
| 2' | Draw the projections of a pentagonal plane of side 30mm resting on H.P. on one of its edge. Its surface is inclined at 30 degrees to the H.P. and the resting edge is making an angle of 45 degrees with the V.P. | [10] |
| 3 | Draw the plan and the elevation of the object shown in figure 1. Give all its dimensions. | [10] |
| OR | | |
| 3' | Draw the half sectional elevation and the plan of the bushed bearing shown in figure 2, showing the dimensions. | [10] |

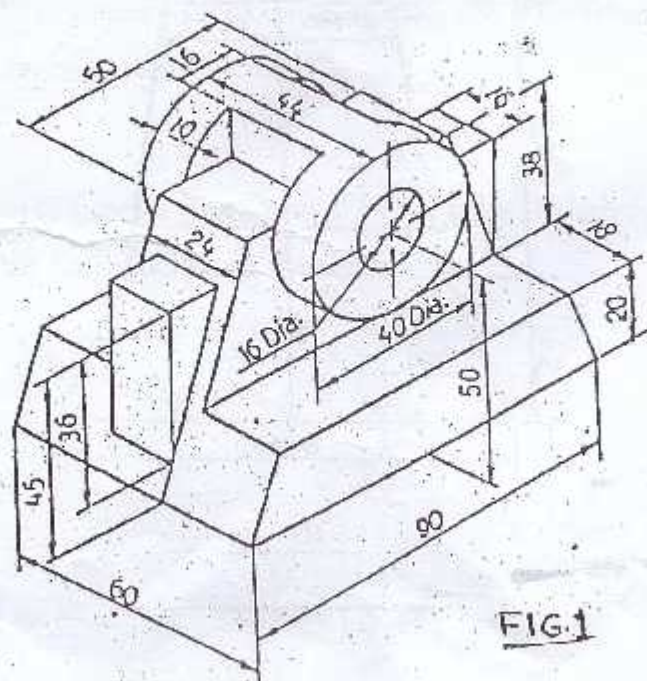


FIG.1

Contd.....2

2013-14

**B.TECH. /B.ARCH. (AUTUMN SEMESTER) EXAMINATION
ALL BRANCHES
ENGINEERING MECHANICS
ME-103**

Maximum Marks: 60

Credits: 04

Duration: Three Hours

Answer all the questions.

Assume suitable data if missing.

Notations used have their usual meaning.

Q.No.	Question	M.M.
1(a)	A 110 N force acting in a vertical plane parallel to the yz plane is applied to the 220 mm long horizontal handle AB of a socket wrench. Replace the force with an equivalent force couple system at the origin O of the coördinate system.(Figure-1)	(06)
1(b)	The rectangular plate shown weighs 300 N and is held in the position shown (Figure-2) by hinges at A and B and by cable EF . Assuming that the hinge at B does not exert any axial thrust, determine (a) the tension in the cable, (b) the reactions at A and B .	(06)
OR		
2(a)	Gear C is rigidly attached to arm AB . If the forces and couple shown (Figure-3) can be reduced to a single equivalent force at A , determine the equivalent force and the magnitude of the couple M .	(06)
2(b)	Knowing that $P = 100$ N, determine the range of values of θ for which equilibrium of the 7.5 kg block is maintained. (Figure-4)	(06)
2(a)	The mechanism shown (Figure-5) is acted upon by the force P ; derive an expression for the magnitude of the force Q required for equilibrium.	(06)

Contd.....2

- 2.(b) Determine the moment of inertia and radius of gyration of the shaded area shown in Figure-6 with respect to the x axes. (06)

OR

- 2.(b') Locate the centroid of the plane area shown. (Figure-7) (06)

- 3.(a) The system shown (Figure-8), consisting of a 20 kg collar A and a 10 kg counterweight B, is at rest when a constant 500 N force is applied to collar A. Determine the velocity of A just before it hits the support at C. (06)

- 3.(b) A 1.5 kg collar is attached to a spring and slides without friction along a circular rod in a horizontal plane (Figure-9). The spring has an undeformed length of 150 mm and a constant $k = 400 \text{ N/m}$. Knowing that the collar is in equilibrium at A and is given a slight push to get it moving, determine the velocity of the collar (a) as it passes through B, (b) as it passes through C. (06)

OR

- 3.(b') A homeowner uses a snowblower to clear his driveway (Figure-10). Knowing that the snow is discharged at an average angle of 40° with the horizontal, determine the initial velocity v_0 of the snow. (06)

- 4.(a) A system consists of three particles A, B, and C (Figure-11). We know that $m_A = 3 \text{ kg}$, $m_B = 2 \text{ kg}$, and $m_C = 4 \text{ kg}$ and that the velocities of the particles expressed in m/s are, respectively, $v_A = 4\mathbf{i} + 2\mathbf{j} + 2\mathbf{k}$, $v_B = 4\mathbf{i} + 3\mathbf{j}$, and $v_C = -2\mathbf{i} + 4\mathbf{j} + 2\mathbf{k}$. Determine the angular momentum H_O of the system about O. (06)

- 4.(b) Two hemispheres are held together by a cord which maintains a spring under compression (the spring is not attached to the hemispheres) (Figure-12). The potential energy of the compressed spring is 120 J and the assembly has an initial velocity v_0 of magnitude $v_0 = 8 \text{ m/s}$. Knowing that the cord is severed when $\theta = 30^\circ$, causing the hemispheres to fly apart, determine the resulting velocity of each hemisphere. (06)

- 2) Small wheels have been attached to the ends of rod AB and roll freely along the surfaces shown (Figure-13). Knowing that wheel A moves to the left with a constant velocity of 1.5 m/s , determine (a) the angular velocity of the rod (b) the velocity of end B of the rod. (06)

OR

- 3) In the position shown (Figure-14), bar AB has an angular velocity of 4 rad./s clockwise. Determine the angular velocity of bars BD and DE . (06)
- 4) An automobile travels to the left at a constant speed of 77.4 km/h (Figure-15). Knowing that the diameter of the wheel is 560 mm , determine the acceleration (a) of point B , (b) of point C , (c) of point D . (06)

FIGURE ENCLOSED

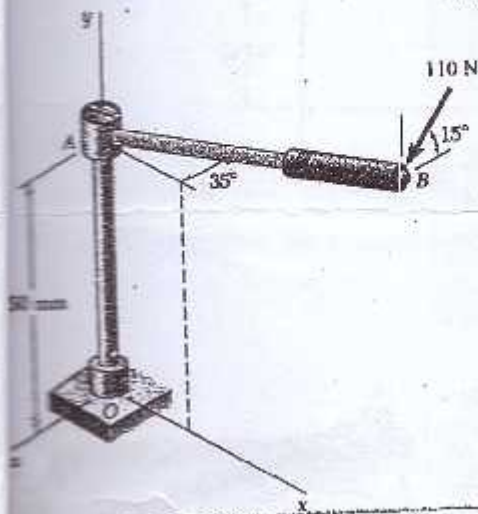


Figure-1

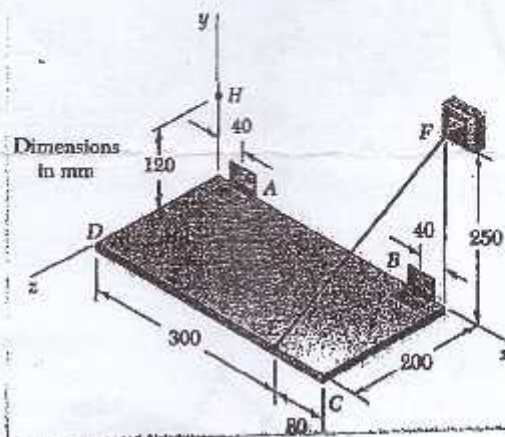


Figure-2

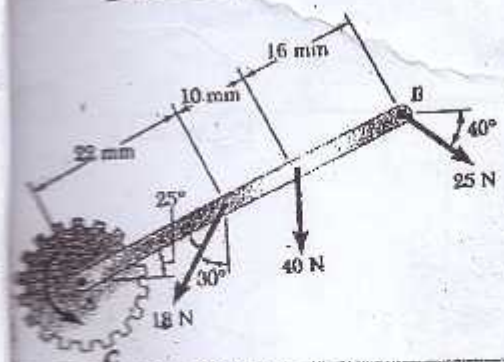


Figure-3

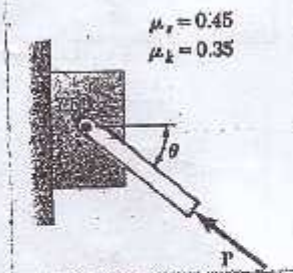


Figure-4

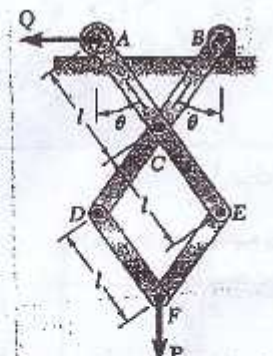


Figure-5

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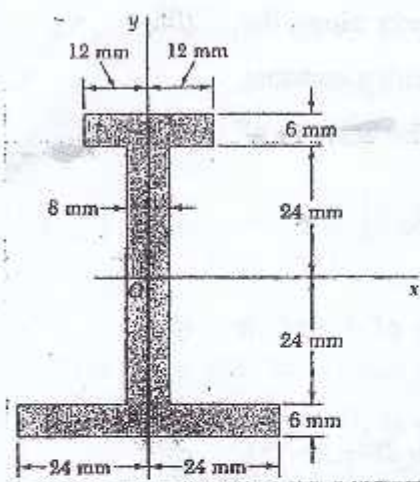


Figure-6

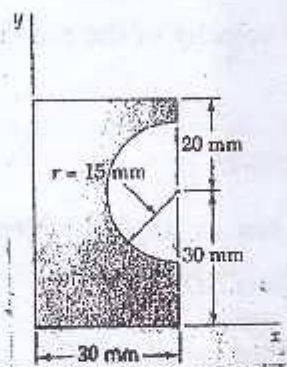


Figure-7

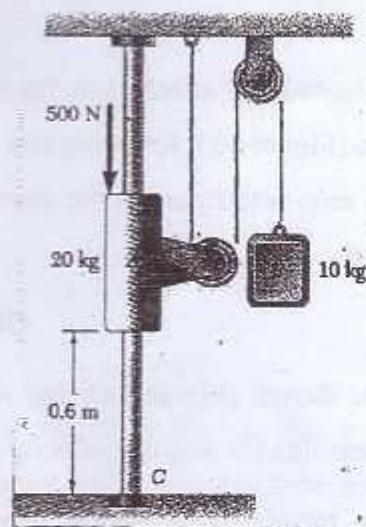


Figure-8

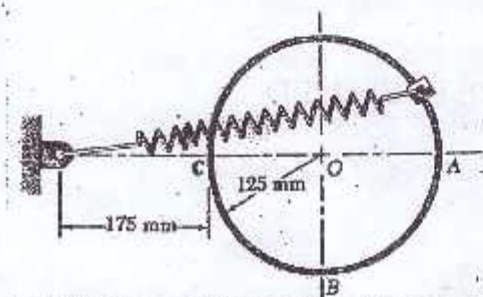


Figure-9

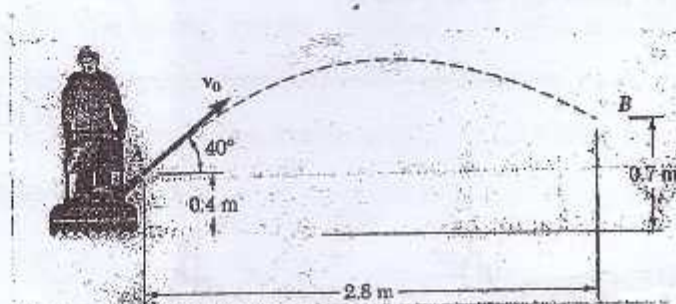


Figure-10

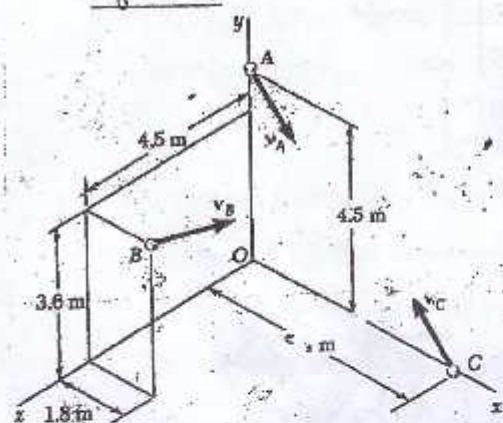


Figure-11

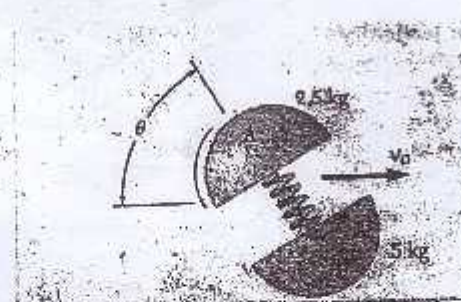


Figure-12

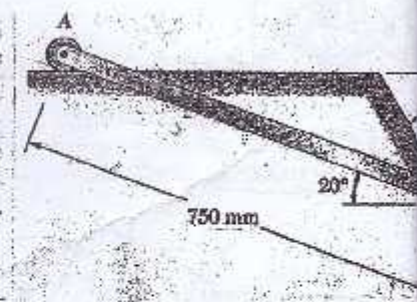


Figure-13

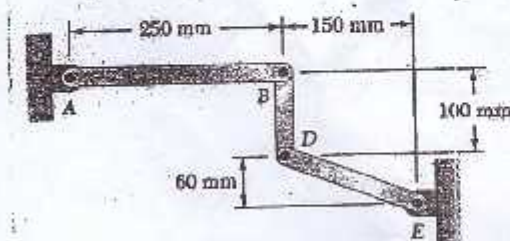


Figure-14

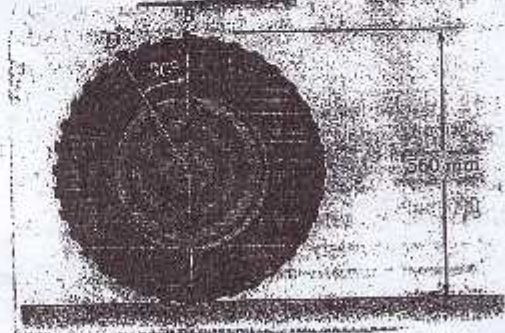


Figure-15

2013-14
B. TECH. (AUTUMN SEMESTER) EXAMINATION
ALL BRANCHES
APPLIED MECHANICS
ME - 111

Maximum Marks: 60

Credits: 04

Duration: Three Hours

*Answer all the questions.**Assume suitable data if missing.**Notations used have their usual meaning.*

Q.No.	Question	M.M.
1.	Two tape spools shown in Fig. 1 are attached to an axle supported by bearings at A and D. The radius of spool B is 30 mm and the radius of spool C is 40 mm. Knowing that $T_B = 80$ N and that the system rotates at a constant rate, determine the reactions at A and D. Assume that the bearing at A does not exert any axial thrust and neglect the weights of the spools and axle.	[12]

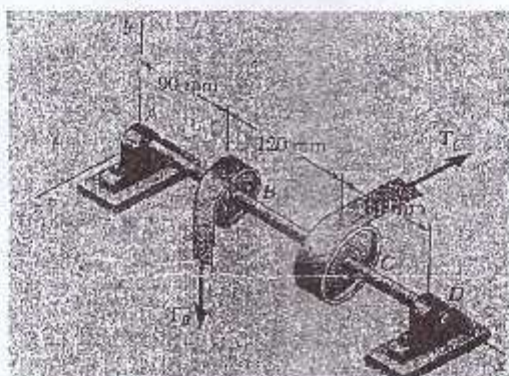


Fig. 1

OR

1(a)	Wire is being drawn at a constant rate from a spool by applying a vertical force P to the wire as shown in Fig. 2. The spool and the wire wrapped on the spool have a combined weight of 20 N. Knowing that the coefficients of friction at both A and B are $\mu_s = 0.40$ and $\mu_k = 0.30$, determine the required magnitude of the force P .	[06]
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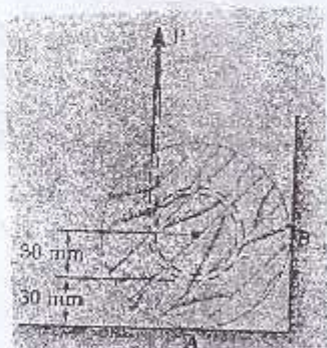


Fig. 2

- 1'(b) For the linkage shown in Fig. 3, determine the couple M required for equilibrium [06]
when $l = 1.8$ m, $Q = 40$ N, and $\theta = 65^\circ$.

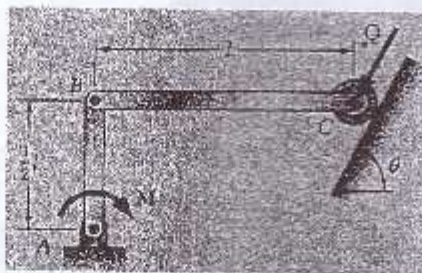


Fig. 3

- 2(a) Water flows from a drain spout with an initial velocity of 0.75 m/s at an angle of 15° [06]
with the horizontal (Fig. 4). Determine the range of values of the distance d for
which the water will enter the trough BC .

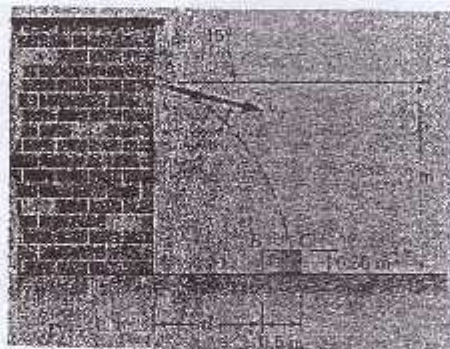


Fig. 4

- 2(b) A 4 kg collar C as shown in Fig. 5 slides on a horizontal rod between spring A and [06]
 B . If the collar is pushed to the right until spring B is compressed 50 mm and
released, determine the distance through which the collar will travel, assuming (a)
no friction between the collar and the rod, (b) a coefficient of friction $\mu_k = 0.35$.

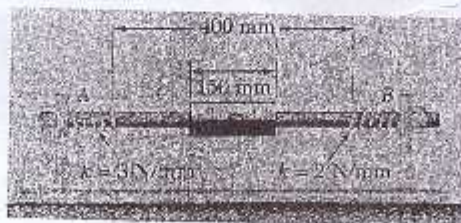


Fig. 5

OR

- 2(a) The masses of blocks A, B, and C shown in Fig. 6 are $m_A = 4 \text{ kg}$, $m_B = 10 \text{ kg}$, and $m_C = 2 \text{ kg}$. Knowing that $P = 0$ and neglecting the masses of the pulleys and the effect of friction, determine (a) the acceleration of each block, (b) the tension in the chord. [06]

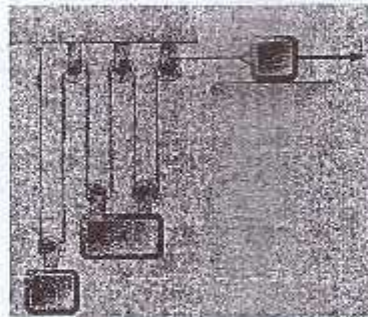


Fig. 6

- 2(b) A system shown in Fig. 7 consists of three particles A, B and C. We know that $m_A = 3 \text{ kg}$, $m_B = 2 \text{ kg}$, and $m_C = 4 \text{ kg}$ and that the velocities of the particles expressed in m/s are, respectively, $\mathbf{v}_A = 4\mathbf{i} + 2\mathbf{j} + 2\mathbf{k}$, $\mathbf{v}_B = 4\mathbf{i} + 3\mathbf{j}$, and $\mathbf{v}_C = -2\mathbf{i} + 4\mathbf{j} + 2\mathbf{k}$. Determine the angular momentum \mathbf{H}_O of the system about O. [06]

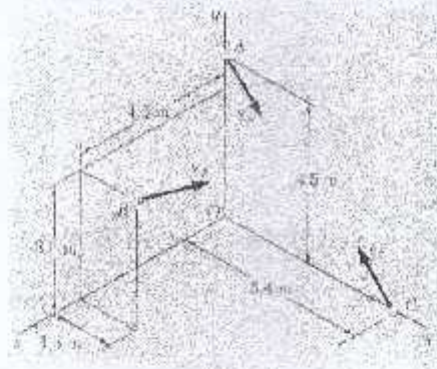


Fig. 7

- 3(a) Two blocks and a pulley are connected by inextensible cords as shown in Fig. 8. The pulley has an initial angular velocity of 0.8 rad/s counter clockwise and a constant angular acceleration of 1.8 rad/s^2 clockwise. After 5 seconds of motion, determine the velocity and position of (a) block A, (b) block B. [06]

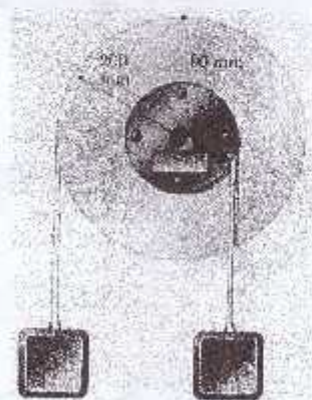
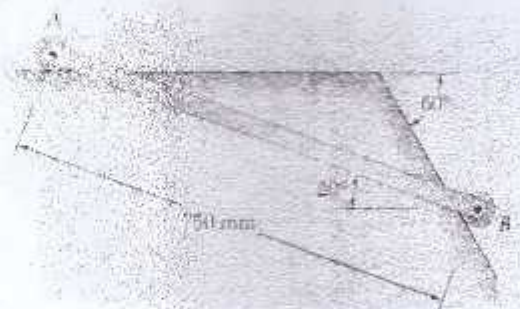


Fig. 8

- 3(b) Small wheels have been attached to the ends of rod AB and roll freely along the surface shown in Fig. 9. Knowing that wheel A moves to the left with a constant velocity of 1.5 m/s, determine (a) the angular velocity of the rod, (b) the velocity of end B of the rod. [06]

Fig. 9



- 4(a) Draw the stress-strain curve for mild steel and show the different points on it. [04]
- 4(b) In a statically determinate structure (Fig. 10), determine the final stresses in each bar. Given: [08]

$$\alpha_{cu} = 2\alpha_s = 12 \times 10^{-6}/^{\circ}\text{C}$$

$$E_s = 2E_{cu} = 2 \times 10^5 \text{ N/mm}^2$$

$$A_{cu1} = A_{cu2} = 2A_s = 12000 \text{ mm}^2$$

$$L_{cu1} = L_{cu2} = L_s = 1000 \text{ mm}$$

Applied load = 800 N (compressive)

Temperature is increased by 40°C .

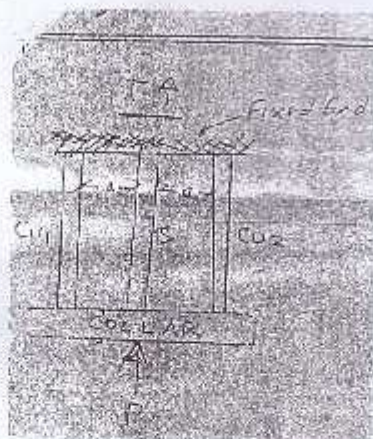


Fig. 10

OR

- 4'(b) Determine the final stresses for the structure as shown in Fig. 11. [08]

Temperature decreases by 40°C .

$$\alpha_{cu} = 2\alpha_s = 12 \times 10^{-6}/^{\circ}\text{C}$$

$$E_s = 2E_{cu} = 2 \times 10^5 \text{ N/mm}^2$$

$$L_{cu1} = L_{cu2} = L_s = 1000 \text{ mm}$$

-- 5 --

$$A_{cu1} = A_{cu2} = 2A_s = 12000\text{mm}^2$$

P = Applied load at fixed ends is 800 N (compressive)

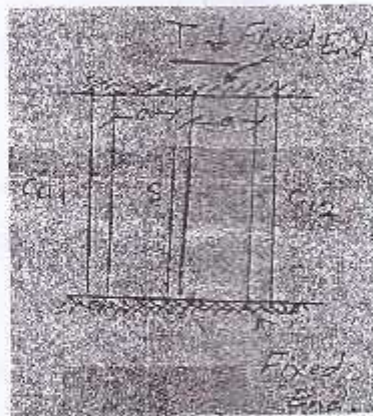


Fig. 11

- 5 Determine the SF and BM (Fig. 12) and draw SFD and BMD.

[12]

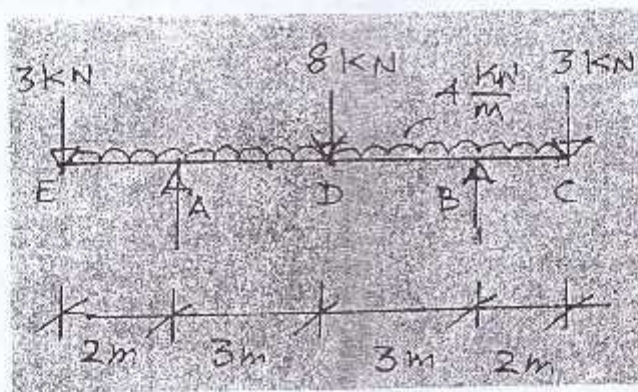


Fig. 12

OR

- 5' Determine the bending stresses for the beam as shown in Fig. 12 and Fig. 13. Draw the bending stress diagram also.

[12]



Fig. 13

2014-2015

B.Tech. (1st Semester) Examination(ELECTRICAL/MECHANICAL/CIVIL/CHEMICAL/ELECTRONICS/
COMPUTER/PETRO-CHEMICAL ENGINEERING)

APPLIED CHEMISTRY

(AC - 111)

Credits: 04

Duration: Three Hours

Maximum Marks: 60

Answer all the questions.

Marks are allotted against each question.

Q.No.	Question	M.M.
1(a)	Give the different steps in gravimetric analysis. Explain in detail the precipitation step in gravimetric analysis.	[04]
1(b)	Draw a labelled curve for the titration of 100 ml of 0.1 M HCl with 0.1 M NaOH.	[02]
1(c)	Differentiate between the primary and secondary standards.	[02]
1(d)	Draw the block diagram of a single beam ultraviolet-visible spectrophotometer.	[02]

OR

1'(a)	Describe the different types of precipitates and impurities therein in gravimetric analysis. Explain different methods used for the minimization of impurities in precipitates.	[05]
1'(b)	Calculate the molar absorptivity of a solution based on the following data. Absorbance = 2.5, width of the sample holder = 1.0 cm, concentration of the solute = 4.5 g/L and molecular weight of the solute = 336.	[2.5]
1'(c)	Give the classification of chromatographic techniques. Explain any one of them.	[2.5]
2(a)	What are the requirements of water for municipal use? List the various steps involved in the treatment of municipal water. Explain disinfection step in details.	[05]
2(b)	Write short notes on: (i) Chemical equations of lime with hardness causing impurities (iii) Caustic embrittlement	[05]

OR

2'(a)	A water sample, on analysis, gave the following constituents in mg/L: $\text{MgCl}_2 = 9.5$, $\text{CaSO}_4 = 34$, $\text{CaCO}_3 = 25.0$, $\text{Mg}(\text{HCO}_3)_2 = 73$, $\text{MgSO}_4 = 60.0$, $\text{SiO}_2 = 2.4$. Calculate the amount of lime and soda required for softening of 40,000 L of water if the	[05]
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Contd. --2,

purities of lime and soda are 85% and 95%, respectively. (The atomic weight of Mg = 24, Ca = 40, Cl = 35.5, O = 16, H = 1, C = 12, S = 32 and Si = 28)

2'(b) Write short notes on the followings:

[3+2]

(i) Sedimentation with coagulation

(ii) Reactions of zeolite with hardness causing impurities

3(a) What is petroleum? What are the various fractions obtained from the fractional distillation of petroleum? Mention the industrial uses of each fraction. [05]

3(b) A coal has the following composition by weight: C = 90%; O = 3%; S = 0.5%; N = 0.5% and ash = 2.5%. Net calorific value of coal was found to be 8,490.5 Kcal/kg. Calculate the percentage of hydrogen and higher calorific value of the coal. [05]

4(a) What is lubrication? Discuss the mechanism of thick film lubrication. [04]

4(b) Write short notes on *any three* of the followings: [06]

(i) Flash point and fire points

(ii) Viscosity and viscosity index

(iii) Saponification value

(iv) Drop point of grease

5(a) Write the mechanism of electrochemical corrosion in acidic environment. [04]

5(b) Differentiate between *any two* of the followings: [06]

(i) Galvanizing and tinning

(ii) Electrochemical series and galvanic series

(iii) Dry corrosion and wet corrosion

6(a) What are the polymers? Differentiate between addition and condensation polymers. [03]

6(b) Discuss the mechanism of free radical addition polymerization with the help of an example. [03]

6(c) Give the preparation, properties and uses of polytetrafluoroethylene (PTFE) or Bakelite. [04]

2014 – 2015
B.TECH. (WINTER SEMESTER) EXAMINATION
ALL BRANCH (BACKLOG)
APPLIED MATHEMATICS – II (OLD COURSE)
(AM – 102)

Credits : 04

Maximum Marks: 60

Duration: Three Hours

Note: Answer all questions.

1. (a) Write salient features and trace the conic

$$16x^2 - 24xy + 9y^2 - 104x - 172y + 44 = 0$$

- (b) Find the equation of the cone with vertex at the origin and passing through the curve

$$x^2 + y^2 = 16, \quad z = 3.$$

OR

- (b') If PSP' and QSQ' are two perpendicular focal chords of a conic, prove that [6,6]

$$\frac{1}{PS \cdot PS'} + \frac{1}{QS \cdot SQ'} \text{ is constant.}$$

2. (a) If $V = (x^2 + y^2 + z^2)^{-1/2}$, show that

$$\frac{\partial^2 V}{\partial x^2} + \frac{\partial^2 V}{\partial y^2} + \frac{\partial^2 V}{\partial z^2} = 0$$

- (b) If $x + y = 2e^{\theta} \cos \phi$ and $x - y = 2ie^{\theta} \sin \phi$, where $i = \sqrt{-1}$, show that

$$\frac{\partial^2 v}{\partial \theta^2} + \frac{\partial^2 v}{\partial \phi^2} = 4xy \frac{\partial^2 v}{\partial x \partial y}.$$

OR

- (b') If $u = xy + yz + zx$, $v = x^2 + y^2 + z^2$, and $w = x + y + z$, show that u, v, w are not independent and find the relation among them. [6,6]

3. (a) Obtain Taylor's expansion of the function $f(x, y) = e^x \cos y$ in the neighbourhood of $\left(1, \frac{\pi}{2}\right)$ upto 2nd degree terms.

- (b) Prove that the rectangular solid of maximum volume which can be inscribed in a sphere is cube. [6,6]

Contd.....2

-- 2 --

4. (a) Find the volume in positive octant of the ellipsoid

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1.$$

- (b) Find by double integration the area lying inside the cardioid $r = a(1 + \cos \theta)$ and outside the circle $r = a$.

OR

- (b') Evaluate the following integral by changing the order of integration

[6,6]

$$\int_0^1 \int_x^{\sqrt{2-x^2}} \frac{x \, dy \, dx}{\sqrt{(x^2 + y^2)}}.$$

5. (a) Find the Fourier series to represent $f(x) = x - x^2$ from $x = -\pi$ to $x = \pi$ and show

$$\text{that } \frac{\pi}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \dots$$

- (b) Find half range cosine series for the function $f(x) = x^2 - 2$ for $-2 < x < 2$.

[7,5]

2014-15

B.TECH. (AUTUMN SEMESTER) EXAMINATION**(Civil/Chemical/ Computer/ Electrical/ Electronics/ Mechanical//Petro-Chemical Engg.)****APPLIED PHYSICS-I****AP-101****Maximum Marks: 60****Credits: 03****Duration: Three Hours***Answer all the questions. Symbols used have their usual meaning.*

- 1(a) What do you understand by effective mass? Derive an expression for effective mass and discuss its dependence on band curvature. [05]
- 1(b) Discuss Hall effect in the case of p-type semiconductor. Obtain an expression for majority carrier concentration in terms of measurable parameters. [06]
- 1(c) Si is doped with 10^{18} As/cm³ at 300 K, where is E_F with respect to E_i ? Also find minority carrier concentration. (Given: $k_B = 1.38 \times 10^{-23}$ J/K, $n_i = 1.5 \times 10^{10}$ cm⁻³) [04]

OR

- 1(c') Discuss with the help of suitable diagrams temperature dependence of carrier concentration in intrinsic and extrinsic semiconductors. [04]
- 2(a) What are the postulates of special relativity? Starting with proper relationship between x and x' , obtain Lorentz transformation equations. [06]
- 2(b) Write down Maxwell's equations. Give a quantitative treatment of the travelling electromagnetic wave and show that $E_m/B_m = c$. [06]
- 2(c) Find the mass (in GeV/c²) of a particle whose total energy and momentum are 4.00 GeV and 1.45 GeV/c respectively. [03]
- 3(a) With the help of suitable diagram describe the construction of an x-ray tube and explain the production of i) continuous and ii) characteristic x-rays. How the presence of the minimum wavelength, λ_{min} is explained in the x-ray spectrum? [7]
- (b) An x-ray machine operates at a certain accelerating voltage such that the value of minimum wavelength, λ_{min} produced is found to be 24.8 pm. Find the accelerating voltage applied in the tube. [3]
- (c) Explain Compton effect (no derivation required) and how this effect is different from pair production? An x-ray photon whose initial frequency was 1.5×10^{19} Hz emerges from a collision with an electron with a frequency of 1.2×10^{19} Hz. How much kinetic energy was imparted to electron? (take $h = 6.63 \times 10^{-34}$ J.s) [5]

OR

- 3'(a) Explain the term 'pair production' and show that it is not possible for the pair production to occur in free space. What nature of radiation is established by the phenomenon of pair production? [04]
- 3'(b) What is a group velocity? Obtain its mathematical expression and show that the group velocity, v_g associated with a moving particle is equal to the velocity, v of the particle itself. [07]
- 3'(c) State Heisenberg's uncertainty principle. If uncertainty in the position of a particle is equal to its de Broglie wavelength, show that the uncertainty in its velocity is equal to its velocity. [04]

Contd... 2.

- 4 (a) What do you mean by a well behaved wave function? Write the steady state form of Schrödinger equation and **solve** it for the energy and the normalized wave function of a particle trapped in a box (**infinite** square potential well) L wide. Plot the wave functions and the corresponding probability densities for the two lowest quantum states.
- 4(b) Show that the expectation value, $\langle x \rangle$ of the position of a particle trapped in a box L wide is independent of its quantum state, i.e., n .
- 4(c) Estimate the probability of finding a particle in a box L wide between $x = 0$ and $x = L/3$ in its first excited state ($n = 2$).

OR

- 4' Discuss tunnel effect quantitatively to obtain an expression for the approximate transmission probability, T of a particle of energy E through a barrier of height U such that $E < U$
-

2014-15

B.TECH. (AUTUMN SEMESTER) EXAMINATION
(Civil/Chemical/ Computer/ Electrical/ Electronics/ Mechanical//Petro-Chemical/Arch. Engg.)
APPLIED PHYSICS
AP-111

Maximum Marks: 60

Credits: 04

Duration: Three Hours

- Answer all the questions. Symbols used have their usual meaning.
- Some useful physical constants are given at the end of the question paper.

- 1(a) What do you understand by direct and indirect band gap semiconductors? Draw E vs. k diagrams for aforementioned semiconductors and give five examples of semiconductors to be used in light emitting devices. [6.0]

OR

- 1(a') Define mobility of a charge carrier. Taking into consideration contribution of electrons and holes, derive an expression for electrical conductivity of a semiconductor. [6.0]
- 1(b) Calculate effective densities of states N_c and N_v for GaAs at 300 K (assume m_n^* and m_p^* do not vary with temperature). Also calculate intrinsic carrier concentration and compare with the given n_i . [4.0]
 [Given: $m_n^* = 0.067 m_e$, $m_p^* = 0.48 m_e$, $n_i = 2 \times 10^6 \text{ cm}^{-3}$ and $E_g = 1.43 \text{ eV}$]

- 2(a) What is the basic principle of optical fiber communication? Taking into account step index fiber, obtain an expression for angle of acceptance hence write expression for numerical aperture. [5.0]
- 2(b) Categorize optical fibers on the basis of refractive index profile. Draw diagrams showing light propagation in these fibers. [2.5]
- 2(c) The core and cladding of silica fiber have refractive indices 1.473 and 1.458 respectively. Calculate (i) critical angle of reflection for core cladding boundary, (ii) acceptance angle for fiber and (iii) numerical aperture [2.5]

- 3(a) Define stimulated emission. Discuss construction and working of a ruby laser with the help of suitable diagrams. Also point out some of the drawbacks of ruby laser. [6.0]

OR

- 3(a') Discuss construction and working of a four level laser. Compare this laser with ruby laser. [6.0]
- 3(b) A typical ruby laser emits radiation of 6943 \AA because of transition between the energy levels of Cr^{3+} ions. If ruby is 7 cm long 0.8 cm in diameter contains $10^{19} \text{ Cr}^{3+} \text{ ions/cm}^3$. What is the maximum energy of a pulse radiation emitted by this ruby laser? If pulse lasts for $5 \times 10^{-9} \text{ sec}$, what is average power of the laser during the pulse? [4.0]

OR

- 3(c') Discuss the applications of laser in holography and isotope separation. [4.0]

contd.... 2.

- 4 What is Compton effect? Give complete quantitative treatment to obtain Compton shift in wavelength. [10.0]

A beam of x-rays is scattered by free electrons. At 45° from the beam direction the scattered x-rays have wavelength of 0.022 \AA . What is wavelength of the incident beam?

OR

- 4' Explain pair production and pair annihilation. Show that pair production cannot take place in free space. [10.0]

A 1.0 MeV positron collides with an electron at rest and the two particles are annihilated. Two photons are produced; one moves in the same direction as the incident positron and the other moves in the opposite direction. Determine the energies of the two photons (Assume rest mass energy of an electron or a positron to be 0.51 MeV).

- 5(a) Discuss physical significance of a wave function? Obtain the time dependent form of Schrodinger equation. [7.0]

- 5(b) Find the probability that a particle trapped in a box L wide can be found between $0.45L$ and $0.55L$ for the ground and first excited states. [3.0]

- 6(a) What is statistical mechanics? Derive an expression for molecular energy distribution, $n(\epsilon)d\epsilon$ in an ideal gas. Use this distribution to show that average energy of ideal gas molecules is $3kT/2$. [7.0]

- 6(b) Find the most probable, average and rms speeds of oxygen molecules at 20°C . [3.0]

OR

- 6(a') Discuss Dulong-Petit law for specific heat of solids and mention its failure. Obtain Einstein's formula for specific heat of solids. [7.0]

- 6(b') The Fermi energy in silver is 5.51 eV . Estimate the average energy of free electrons in silver at 0 K . What temperature is necessary for the ideal gas molecules to acquire this value of average energy [3.0]

Some useful physical constants

$$\begin{aligned}
 h &= 6.63 \times 10^{-34} \text{ J.s}, & k_B &= 1.38 \times 10^{-23} \text{ J/K}, \\
 m_e &= 9.1 \times 10^{-31} \text{ kg}, & m_p &= 1.67 \times 10^{-27} \text{ kg}, & m(\text{O}_2) &= 32 \text{ amu}, & c &= 3 \times 10^8 \text{ m/s} \\
 n_i(\text{Si}) &= 1.5 \times 10^{16} \text{ m}^{-3}, & q_e &= 1.6 \times 10^{-19} \text{ C}, & 1 \text{ amu} &= 1.66 \times 10^{-27} \text{ Kg}
 \end{aligned}$$

2014-15
B.ARCH. FIRST SEMESTER EXAMINATION
ARCHITECTURAL DRAWING - I
AR-103

Maximum Marks: 40

Credits: 04

Duration: Three Hours

Answer all the questions.

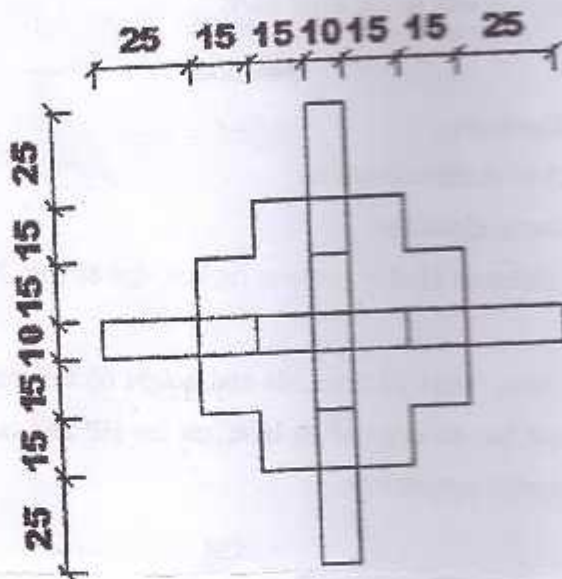
Assume suitable data if missing.

Neat and good drafted drawings will be credited more.

Q.No.	Question	M.M.
1	Represent the followings:-	
	a) A school bus in side elevation.	3
	b) A palm tree in elevation.	3
	c) Any two different kind of textures (in box size 80 mm X 60 mm)	4
2	A hexagonal prism, base 30 mm side and height 65 mm has its axis inclined at 45° to the HP and has an edge of its base on the HP and inclined at 30° to VP. Draw its orthographic projections.	10
OR		
2'	A hexagonal pyramid, base 30 mm side and height 60 mm, has one of its slant edges on ground. A plane containing that edge and the longitudinal axis is perpendicular to the HP and inclined at 45° to the VP. Draw its orthographic projections.	10
3	A cylinder of base diameter 50 mm and height 50 mm is resting on ground on its base. It is being cut by a plane in such a way that in elevation it appears as two equal right angle triangles of base 50 mm and height 50 mm. Draw the development of lateral surface of bottom part of truncated cylinder.	10

Contd2.

- 4 Draw isometric view of the object shown in figure - 1.



PLAN AND ALL ELEVATIONS

(All Dimensions are in mm)

FIGURE - 1

2014-15
B.ARCH. (AUTUMN SEMESTER) EXAMINATION
B. ARCH I- YEAR
PRINCIPLES & PHILOSOPHY OF ARCHITECTURE
AR-112

Maximum Marks: 60

Credits: 04

Duration: Three Hours

Answer all the questions.

Draw sketches to support your answer.

Q.No.	Question	M.M.
1	Define the term architecture, how it is both art and science as discipline?	[10]
	OR	
1'	What are the qualities required for being a good Architect?	[10]
2	Explain with neat sketch the basic Principles of Architectural Design?	[10]
3	What are the indispensable elements of architectural design, explain how different planes are employed in any architectural symphony?	[10]
4	How history as a subject is important in Architecture, explain with neat sketches?	[15]
5	What are the various elements Laurie Baker used in his buildings, explain his philosophy and important works with neat sketches?	[15]
	OR	
5'	Explain the philosophy of Louis I Kahn and define with neat sketch the elements used by him in IIM Ahmedabad?	

2014-15

B.TECH. (AUTUMN SEMESTER) EXAMINATION
ELECTRONICS/COMPUTERS/ELECTRICAL/MECHANICAL/CIVIL/CHEMICAL/
PETROCHEMICAL/B. Arch
ENVIRONMENTAL STUDIES
CE111

Maximum Marks: 60

Credits: 04

Duration: Three Hours

*Answer all the questions.**Assume suitable data if missing.**Notations used have their usual meaning.*

Q.No.	Question	M.M.
1(a)	Describe energy and nutrient flow in an ecosystem?	[04]
OR		
1'(a)	Briefly describe the significance of biological magnification of pollutants through food chain. Illustrate with an example.	[04]
1(b)	What reactions are responsible for the formation of photochemical smog	[02]
1(c)	Define ecosystem. List biotic and abiotic components of a pond ecosystem	[04]
2(a)	Briefly describe the effects of carbon monoxide and SO_x on human health	[04]
2(b)	Determine the effective height of a stack, given the following data:	[04]
	(i) Physical stack is 180 m tall with a 0.95m inside diameter	
	(ii) Wind velocity is 2.75 m/s	
	(iii) Air temperature is 20°C	
	(iv) Barometric pressure is 1000 millibars	
	(v) Stack gas velocity is 11.12 m/s	
	(vi) Stack gas temperature is 160°C	
OR		
2'(b)	Briefly describe the working of any two equipments used for particulate control	[04]
2'(c)	Define dry adiabatic lapse rate and briefly explain its significance on atmospheric stability.	[02]
3(a)	What are the various ways of expressing the strength of a solution? Briefly explain	[04]

Contd - 2

each of them.

- 3(b) Describe nitrogen cycle and explain its significance in environmental engineering? [04]
- 3 (c) Define persistent organic pollutants and name the important persistent organic pollutants found in environment. [02]
- 4 (a) Briefly describe the chemical water quality parameters of concern to human health [04]
- 4 (b) What is the difference between coagulation and flocculation? Briefly describe the mechanisms of coagulation. [04]
- 4 (c) What happens when wastewater is discharged to a river? [02]
- 5 (a) Explain the significance of COD test over BOD test? An analysis for BOD₅ is to be run on a sample of wastewater. The BOD is expected to range from 50 to 350, and dilutions are prepared accordingly. In each case, a standard 300 ml BOD bottle is used. The data are recorded below: [04]

Bottle No	Wastewater (ml)	DO _t	DO _s
1.	20	8.9	1.5
2.	10	9.1	2.5
3.	5	9.2	5.8
4.	2	9.2	7.5

Find the average BOD₅ of the wastewater.

- 5 (b) Briefly describe the BOD removal mechanism in stabilization Ponds [02]
- 5 (c) Draw growth curve of microorganisms under limited substrate conditions and explain each phase. [04]

OR

- 5' (c) Design a rectangular primary clarifier for the treatment of 15 MLD of sewage assume surface overflow rate as $30 \text{ m}^3/\text{m}^2\cdot\text{d}$ [04]
- 6 (a) Describe the sources of municipal solid waste [04]
- 6 (b) Describe the flow diagram of solid waste management and write the different functional elements. [02]
- 6 (c) Briefly describe the composting method of disposal of solid waste [04]

OR

- 6'(c) Explain the parameters used for characterization of solid waste [04]

B.Tech/B.Arch Autumn (I Semester) Examination
(Civil/Electrical/Electronics/Computer/Chemical/Petro-Chemical & Mechanical Engineering)
Basic Electrical Engineering (EE-101)

Maximum Marks: 60

Credits: 03

Duration: Three Hours

1. Answer all the questions.
2. Assume suitable data if missing.
3. Notations used have their usual meaning.

Q.No.	Questions	M.M
1(a)	Define apparent power, active and reactive power as related to ac circuits. Also prove that the active power in a pure inductance is zero.	[06]
1(b)	An alternating voltage $(80+j60)$ V is applied to a circuit and the current flowing is $(-4+j10)$ A. Find: <ol style="list-style-type: none"> a. The Impedance of the circuit b. Power factor c. Power consumed 	[06]

OR

- 1'(a) Using phasor diagram, obtain the relationship for line and phase current for delta connected system. [06]
- 1'(b) Determine the voltage across the 2Ω resistor in figure 1 by using Norton's theorem. [06]

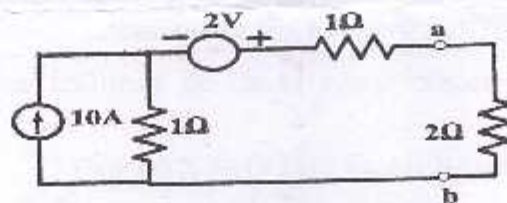


Figure 1

- 2(a) A 100kVA, single phase, 1100/220 V, 60 Hz transformer has a high voltage resistance of 0.1Ω and a leakage reactance of 0.3Ω . The low voltage winding resistance is 0.004Ω and the leakage reactance of is 0.012Ω . Determine the equivalent winding resistance and reactance referred to the low voltage side. [06]
- 2(b) What are the differences and similarities between electrical & magnetic circuits? [06]

OR

- 2' An inductor has a core built up of stampings of the shape shown in figure 2, the coil being on the central limb. There is a 1mm air-gap in the centre limb which has a cross-sectional area of 4 cm^2 . All other paths in the core have a cross-section area of 2 cm^2 . The mean path lengths of the magnetic flux in each portion of the core are as shown in the figure. If the relative permeability of the iron is 800, find the current needed in the coil of 500 turns to produce a total flux in the air-gap of 0.8 mWb . [12]

Conld. 2

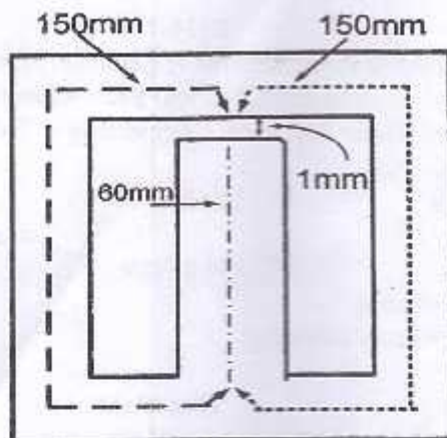


Figure 2

- 3(a) Explain the production of rotating magnetic field in a three phase induction motor. [04]
- 3(b) Discuss the principle of operation of a three-phase alternator. [04]
- 3(c) Why a single-phase induction motor is not self starting? [04]
- 4(a) With the help of a suitable diagram explain the construction and principle of operation of a moving iron (MI) instrument. [06]
- 4(b) Describe with a neat diagram the functioning of induction type single phase energy meter. [06]
- 5(a) Discuss the function of the following equipment in a steam power station: Condenser, cooling towers, feed water heater and economiser. [06]
- 5(b) How can hydroelectric power plants be classified according to: (i) water flow regulation; (ii) head; (iii) load and (iv) plant capacity. [06]
- Also Discuss the factors affecting the site selection for a hydro power project.

OR

- 5'(a) Write short note on solar photovoltaic power plant. [05]
- 5'(b) With the help of a neat block diagram explain the functioning of coal fired thermal power plant. Also explain the function of Superheater. [07]

2014-15

B.Tech/B.Arch Autumn (I Semester) Examination
 (Civil/Electrical/Electronics/Computer/Chemical/Petro-Chemical & Mechanical Engineering)
Basics of Electrical & Electronics Engineering (EE-111)

Maximum Marks: 60

Credits: 04

Duration: Three Hours

*Answer all the questions.**Assume suitable data if missing.**Notations used have their usual meaning.***Part A (Q.1&2) and Part B (Q.3&4) questions are to be attempted in separate copies.****PART A**

Q.No.

M.M

- 1(a) Using phasor diagram, obtain the relationship for line and phase current for delta connected system. [05]
- 1(b) Determine the current I in the network in figure 1 by 'Thevenin's theorem'. [05]

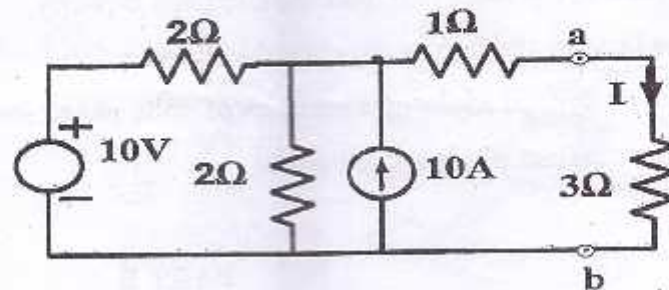


Figure 1

- 1(c) A 100kVA, single phase, 1100/220 V, 60 Hz transformer has a high voltage resistance of 0.1Ω and a leakage reactance of 0.3Ω . The low voltage winding resistance is 0.004Ω and the leakage reactance of is 0.012Ω . Determine the equivalent winding resistance and reactance referred to the high voltage side. [05]

OR

- 1'(a) A single phase transformer working at unity power factor has an efficiency of 90% at both half load and at the full load of 500 W. Determine the efficiency at 75% full load and the maximum efficiency. [05]

contd-

- 1'(b) What are different types of magnetic losses? How can they be minimized? [05]
- 1'(c) In the network shown in figure 2 determine a) total impedance; b) total current, I; [05]
c) overall power factor; d) active power and d) Reactive volt-amperes.

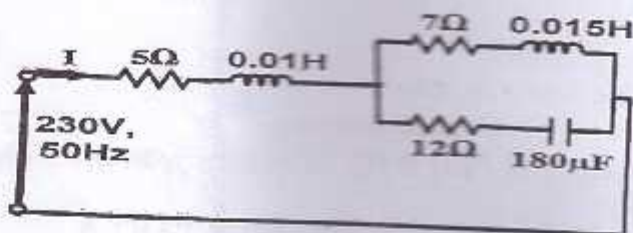


Figure 2

- 2(a) With the help of a suitable diagram explain the construction and principle of operation of a permanent magnet moving coil (PMMC) instrument. [05]
- 2(b) How can hydroelectric power plants be classified according to: (i) water flow regulation; (ii) head; (iii) load and (iv) plant capacity. [05]
- Also Discuss the factors affecting the site selection for a hydro power project.
- 2(c) What is the principle of operation of split phase motor? Draw neat sketch and phasor diagram of split phase motor. [05]

PART B

- 3(a) Explain terminal characteristics of $p-n$ junction diode in forward and reverse bias regions. [06]
- 3(b) Explain the following terms: [09]
(i) Peak inverse voltage and Zener breakdown phenomenon
(ii) Virtual short in operational amplifier
(iii) Diffusion and drift current

OR

- 3'(b) Design the circuit shown below (in figure 3) to provide an output voltage of 2.4V. [09]
Assume that the diodes available have 0.7V drop at 1mA and that $\Delta V = 0.1V/\text{decade}$ change in current.

Contd... 3.

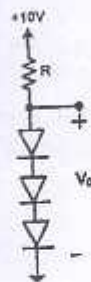


Figure 3

- 4(a) Differentiate between Enhancement type and Depletion type N-channel MOSFET. [06]
Also draw i_D-v_{GS} (saturation) and i_D-v_{DS} characteristics with proper labelling for both types of MOSFETs.
- 4(b) Explain the functioning of OPAMP-based inverting integrator. [04]
- 4(c) Derive an expression for the voltage gain, V_o/V_i for the circuit shown in figure 4: [05]

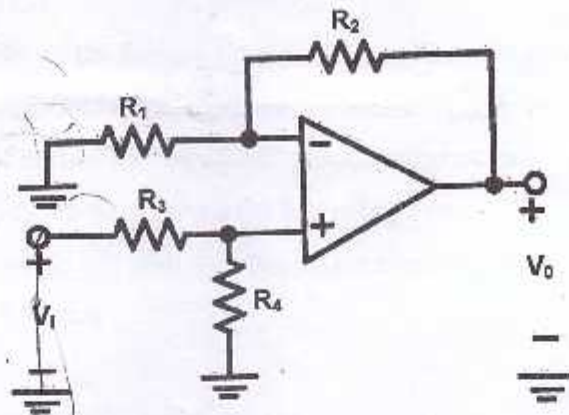


Figure 4

OR

- 4'(c) Explain the function of operational amplifier-based weighted summer. Design a weighted summer using two opamps and resistors that implements the following function: [0]

$$v_0 = v_1 + v_2 - 3v_3 - 4v_4$$

B.ARCH. / B.TECH. /AUTUMN (I SEMESTER) EXAMINATION
(ELECT./ MECH./ CIVIL/ CHEM./ ELECTRONICS / COMPUTER
PETRO-CHEMICAL ENGINEERING)

ENGLISH

(EN-101)

Credits:04

Maximum Marks: 60

Duration: Three Hours

Answer all questions.

1.(a) Read the passage and answer the questions that follow:

5x2=10

Experiments have shown that in selecting personnel for a job, interviewing is at best a hindrance and may even cause harm. These studies have disclosed that the judgments of interviewers differ markedly and bear little or no relationship to the adequacy of job applicants. Of the many reasons why this should be the case, three in particular stand out. The first reason is related to an error of judgment known as the halo effect. If a person has one noticeable good trait, their other characteristics will be judged as better than they really are. Thus, an individual who dresses smartly and shows self-confidence is likely to be judged capable of doing a job well regardless of his or her real ability. The horns effect is essentially the same error, but focuses on one particular bad trait. Here the individual will be judged as incapable of doing a good job.

Interviewers are also prejudiced by an effect called the primacy effect. This error occurs when interpretation of later information is distorted by earlier connected information. Hence, in an interview situation, the interviewer spends most of the interview trying to confirm the impression given by the candidate in the first few moments. Studies have repeatedly demonstrated that such an impression is unrelated to the aptitude of the applicant.

The phenomenon known as the contrast effect also skews the judgment of interviewers. A suitable candidate may be underestimated because he or she contrasts with a previous one who appears exceptionally intelligent. Likewise, an average candidate who is preceded by one who gives a weak showing may be judged as more suitable than he or she really is.

Since interviews as a form of personnel selection have been shown to be inadequate, other selection procedures have been devised that more accurately predict candidate suitability. Of the various tests devised, the predictor that appears to do this most successfully is cognitive ability as measured by a variety of verbal and spatial tests.

- (i) What does the author mean by the phrase 'essentially the same error'?
 - (a) The effect of the error is the same
 - (b) The error is based on the same kind of misjudgement. 02
 - (c) The effect focuses only on negative traits.
 - (d) The individual is considered less capable of the job.
 - (ii) Explain the primacy effect in an interview, 02
 - (iii) In addition to the interview as a selection procedure, what other ways have been devised? 02
 - (iv) Give synonyms for the following words: 02
hindrance, trait, prejudice, disclose
 - (v) According to the passage, what kind of a person has better chances of being selected based on interview as a selection procedure? 02
- (b) Write a summary of the passage given above. 10

UNIT-II

2. What were the Seven Commandments that the Old Major had set for the Animal Farm at the beginning of the novel? 05

OR

Give a brief character sketch of Napoleon.

3. What is the author's philosophical view of the future and of the direction which humanity will eventually take in The Time Machine? 05

What kind of people were the Eloi? What was their life like?

UNIT-III

10

4. Read the passage and answer the question that follows:

Technology is available to exploit the potential energy formed by tides for the generation of electrical energy. The basic structure is a barrage or dam built across a river estuary or at the mouth of a bay. This dam is similar to that used in hydroelectric power plants built across flowing rivers. At regular intervals along the dam, gates and turbines are installed. When the tide is rising, the gates are opened. This allows water to flow into the area behind the barrage, raising the water level there. When the water has reached its highest level, the gates are closed. Then the tide drops on the seaward side, and this trapped water is several meters above the sea level. The gates are then opened, allowing the water to discharge out. The force of the flow turns the turbines and generates electricity. It is also possible to use tidal energy when the water flows in the other direction - through the gates into the estuary from the sea.

In this way, four periods of energy production are possible every day, since coastal regions experience two high and two low tides in just over 24 hours. In order for practical amounts of electricity to be generated, the difference between high and low tides must be at least five meters. Tidal power is renewable, non-polluting, and contributes no greenhouse gases to the atmosphere. This kind of system can provide a useful energy supplement to other sources in an era of diminishing fossil fuel reserves.

Make notes of the passage given above.

OR

Write the process of making a power point presentation.

UNIT-IV

05

5. Read the following passage and write a précis of the same.

People are questioning the addition of fluoride to water since studies have shown that it may lead to potential health hazards.

Fluoride exists in different quantities in our water supplies. Early studies showed that it was important for the development and health of teeth. According to these studies fluoride improved the enamel of developing teeth so that teeth were stronger, acid resistant, and helped the body rebuild damaged enamel.

Without people giving their consent, fluoride was added to the water in some areas where the amounts were low. However, new studies do not show a difference between the development of healthy teeth in areas of low and high amounts of fluoride in the water. The extra fluoride in the water may actually harm the environment. Also, it has been shown to accumulate in people's bodies and cause side effects.

People should not allow themselves to be guinea pigs in a fluoride experiment, and fluoride supplements should not be added to water or toothpaste.

Fluoride should not be added to water like the dentists said that it should in the 1930s studies. It has been found that the teeth of children in areas where there is little fluoride in the water are no different than those of children in areas where there is a lot of fluoride in the water. So the results of the early studies are wrong.

Not only does fluoride not do all the things that it supposedly does, like reduce the solubility of tooth enamel and stop plaque organisms from making acids that break down enamel, but it also causes problems in the water supply, like is a poisonous waste in water. It can also cause side effects in animals, but I don't think animals should be used in testing experiments and neither should people. People should be able to say if they want to have fluoride in their water.

In conclusion, our governments should not allow fluoride to be added to our water supply cause it is bad for us.

(Approx 355 words)

$\frac{1}{3}$

(120)

Contd...3.

UNIT-V

6. Complete the following by choosing the appropriate words from the given list: 05
- The mathematics to which our _____ are exposed at school is, with rare _____, based on the classical yes- or- no, right -or-wrong _____ of logic. It normally doesn't include one word about _____ as a mode of reasoning or as a basis for _____ several alternative conclusions.
- (exceptions, probability, youngsters, comparing, logic)
7. Write an essay on any one of the following topics in about 300 words: 10
- (i) The future of Engineering
 - (ii) Television as a medium of education.

2014-15

**B. ARCH. / B. TECH. (AUTUMN SEMESTER) EXAMINATION
THERMAL SCIENCES
(ME-101)**

Maximum Marks: 60**(Credits 04)****Duration: Three Hours**

Answer all questions

Draw suitable diagrams, wherever necessary

Assume suitable data, wherever necessary

Use of steam table is allowed

- 1(a) Define property, state, path and process. [04]
- 1(b) With the help of any suitable thermodynamic diagram explain why a quasi-static process only can be shown on it by a line or a curve. [04]
- 1(c) A U-tube mercury manometer with one arm open to atmosphere is used to measure pressure in a steam pipe. The level of mercury in open arm is 97.5 mm greater than that in the arm connected to the pipe. Some of steam in the pipe condenses in the manometer arm connected to the pipe. The height of this column is 34 mm. The atmospheric pressure is 760 mm of Hg. Find the absolute pressure of steam in bar. [04]
- 2(a) A gas in a closed system expands in a quasi-equilibrium process from a volume of 0.20 m^3 at 200 kPa, 80°C to a volume of 0.60 m^3 in such a manner that: $p = 225 - 125V$, where p in kPa and V in m^3 . How much work is done? [05]
- 2(b) A system consisting of a mixture of air and gasoline vapour at an initial temperature of 15°C is contained in a rigid vessel. The mixture undergoes the following processes in sequence. [07]
- The mixture temperature is raised to 200°C by a heat transfer of +3 kJ.
 - The mixture is ignited and burns completely; this process is adiabatic and temperature rises to 1500°C .
 - The temperature of the product of combustion is reduced to 120°C by a heat transfer of -32 kJ.

Evaluate the energy of the system after each process given that the initial energy of the system is 10 kJ.

OR

contd.-2.

2'(a) A mass of two kilograms of water at a temperature of 18°C is poured into an insulated copper vessel which initially is at a temperature of 15°C . When the temperatures have equalized, the water is at a temperature of 17.4°C . Determine the magnitude and sign of the heat transfer for each of the following three system: [04]

- (i) The vessel and the insulation (ii) The water (iii) The vessel and the insulation plus the water.

2'(b) In water cooling tower air enters at a height of 1 m above the ground level and leaves at a height of 7 m. The inlet and outlet velocities are 20 m/s and 30 m/s respectively. Water enters at a height of 8 m and leaves at a height of 0.8 m. The velocity of water at entry and exit are 3 m/s and 1 m/s respectively. Water temperatures are 80°C and 50°C at the entry and exit respectively. Air temperatures are 30°C and 70°C at the entry and exit respectively. The cooling tower is well insulated and a fan of 2.25 kW drives the air through the cooling tower. Find the air required in kg per kg of water flow. Use $\Delta h = C_p \Delta t$ and C_p of air as 1.005 kJ/kg K and for water as 4.187 kJ/kg K. [08]

3(a) State two property rule and sketch a neat p-h diagram for a simple compressible substance showing clearly all the regions, boundaries and significant points. [07]

3(b) A pure substance is contained in a cylinder closed by a piston. The substance undergoes a fully-resisted, constant pressure process in which the only work done is the displacement work at the slowly-moving piston face. Show that the heat transfer during the process is equal to the increase in the enthalpy of the substance. [05]

OR

3'(a) Find the enthalpy and entropy of steam when the pressure is 2 MPa and the specific volume is $0.09 \text{ m}^3/\text{kg}$. [04]

3'(b) A vertical cylinder, fitted with a frictionless leak-proof piston contains 0.03 kg of dry saturated steam. The upper face of the piston is exposed to the atmosphere; the weight of the piston is such that the steam pressure is 300 kN/m^2 . A quantity of saturated water at the same pressure is introduced into the cylinder and mixes thoroughly with the steam. When the mixture is heated subsequently, with the piston held stationary, its state passes through the critical point. Find the mass of water introduced. [08]

Contd.-B

4. State Kelvin-Planck and Clausius statements of second law of thermodynamics and prove their equivalence. [12]

OR

- 4' In a refrigerating plant shown in figure 1 the states of the working fluid (Freon-12) between the various component are as follows: [12]

State 1: Wet vapour at -15°C ; **State 2:** Dry saturated vapour at 30°C ; **State 3:** saturated liquid at 30°C ; **State 4:** Wet vapour at -15°C .

The heat transfer from condenser $q_1 = 1.5 \text{ kJ/s}$ and compressor power requirement is 310 W. All heat transfers to the atmosphere, and also fluid velocities may be assumed to be negligible. Sketch the cycle on p-h diagram and using the given data calculate:

- Mass flow rate of Freon in kg/s.
- The heat transfer rate q_2 from the cold region.
- The enthalpy after expansion valve.
- The enthalpy and dryness fraction at compressor entry.
- The COP.

Properties of Freon-12

Pressure, MPa	Saturation Temperature, $^{\circ}\text{C}$	Specific Enthalpy, kJ/kg	
		Saturated liquid	Saturated vapour
0.1825	-15	22.3	181.0
0.745	30	64.6	199.6

- 5(a) A reversible heat engine operates between two systems at constant temperatures of 600°C and 40°C . The engine drives a reversible refrigerator which operates between system at constant temperature of 40°C and -20°C . The heat transfer to the heat engine is 2000 kJ and the net work output of the combined engine-refrigerator plant is $350 \times 10^3 \text{ Nm}$. Evaluate the heat transfer to the refrigerant and net heat transfer to the system at 40°C . [08]
- 5(b) State thermodynamic definition of positive work and prove its superiority by applying to an electric battery discharging through a resistor. [04]

- 4 -

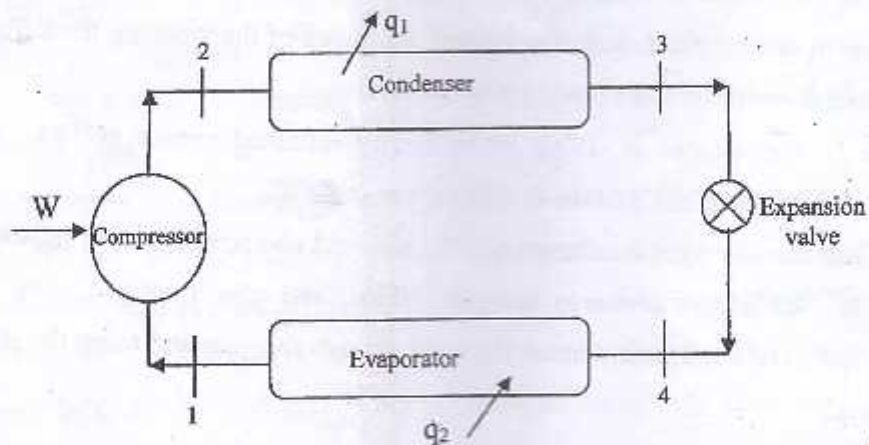


Figure 1

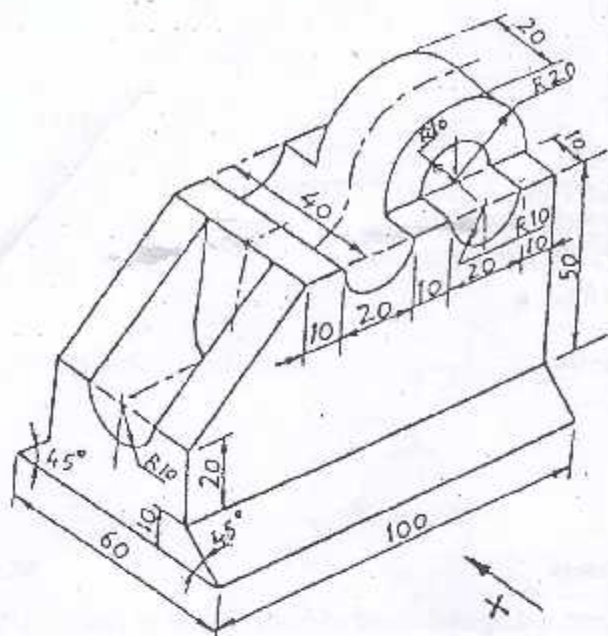


Fig. 1

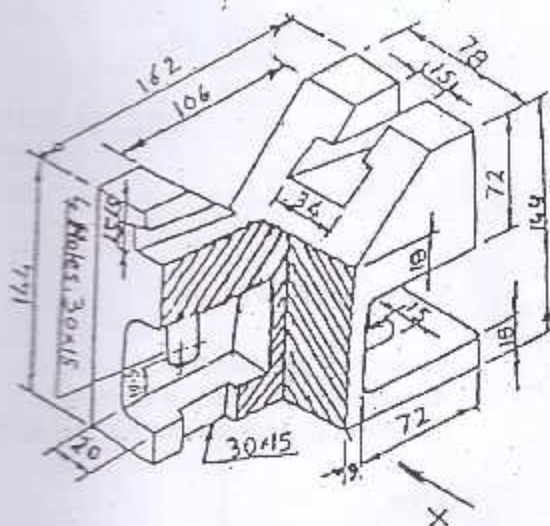


Fig. 2

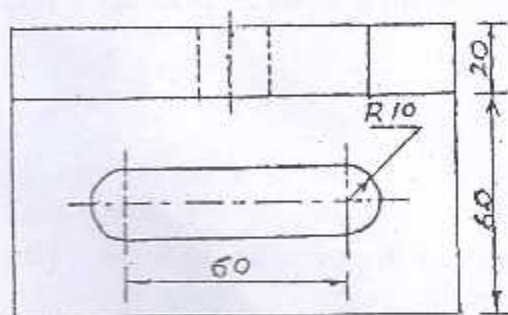
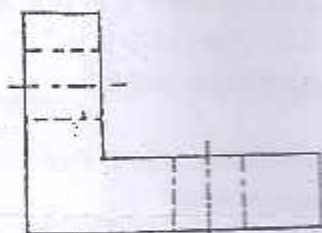
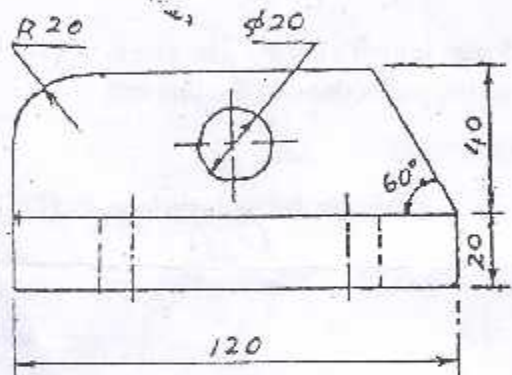


Fig. 3

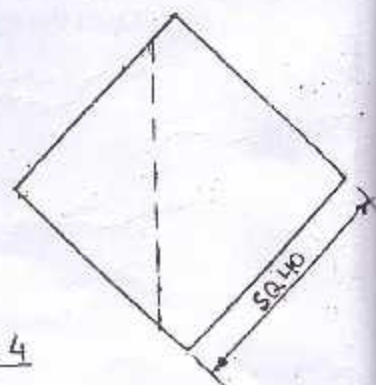
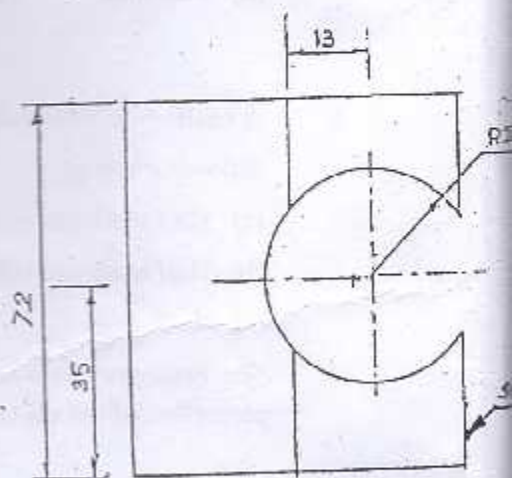


Fig. 4

B.TECH. (AUTUMN SEMESTER) EXAMINATION
MECHANICAL ENGINEERING
ENGINEERING MECHANICS
ME 103

Maximum Marks: 60

Credits: 04

Duration: Three Hours

*Answer all the questions.**Assume suitable data if missing.**Notations used have their usual meaning.*

Q.No.	Question	M.M.
1	Answer any two of the following.	
a)	Two forces P and Q are applied as shown in figure 1(a) to an aircraft connection. Knowing that the connection is in equilibrium and that $P = 500 \text{ N}$ and $Q = 650 \text{ N}$, determine the magnitudes of the forces exerted on the rods A and B.	[06]
b)	The lever BCD is hinged at C as shown in figure 1(b) and attached to a control rod at B. Determine the maximum force P which can be safely applied at D if the maximum allowable value of the reaction at C is 1000 N.	[06]
c)	Two 10° wedges of negligible weight are used to move and position the 163 kg block. Knowing that the coefficient of the static friction at all surfaces of contact is 0.25 determine the smallest force P that should be applied as shown in figure 1(c) to one of the edges.	[06]
2	Answer any two of the following.	
a)	For the plane area shown in figure 2(a), determine i) The first moments with respect to the x and y axes. ii) The location of the centroid.	[06]
b)	Determine the moment of inertia of the shaded area shown in figure 2(b), with respect to each of the coordinate axes.	[06]
c)	A thin semielliptical plate shown in figure 2(c) has a mass ' m ' determine the mass moment of inertia of the plate with respect to (i) the centroidal axis BB' (ii) the centroidal axis CC' that is perpendicular to the plate.	[06]
3	Answer any two of the following.	
a)	Slider block B, shown in figure 3(a), moves to the right with a constant velocity of 300 mm/s. Determine i) The velocity of slider block A. ii) The velocity of portion C of the cable iii) The velocity of portion D of the cable iv) The relative velocity of portion C of the cable with respect to slider block A	[06]

Contd... 2.

- 2 -
- b) The nozzle at A, shown in figure 3(b), discharges cooling water with an initial velocity V_0 at an angle of 6° with the horizontal onto a grinding wheel 350 mm in diameter. Determine the range of values of the initial velocity for which the water will land on the grinding wheel between points B and C. [06]
- c) The rotation of the rod OA about O, as shown in figure 3(c) is defined by the relation $\theta = \pi(4t^2 - 8t)$, where θ and t are expressed in radians and seconds respectively. Collar B slides along the rod so that its distance from O is $r = 10 + 6\sin \pi t$ where r is in millimeter. When $t = 1$ s, determine [06]
- The velocity of the collar.
 - The total acceleration of the collar
 - The acceleration of the collar relative to the rod.

- 4(a) The 20 kg block B is suspended from a 2 m chord attached to the 30 kg cart A which can roll freely on a frictionless horizontal track, as shown in figure 4(a). If the system is released from rest when $\theta = 35^\circ$, determine the velocities of A and B when $\theta = 0$. [06]
- 4(b) An 80 kg man and a 60 kg woman stand at opposite ends of a 130 kg boat, ready to dive, each with a 5 m/s velocity relative to the boat. Determine the velocity of the boat after they have both dived, if [06]
- The woman dives first
 - The man dives first

5 Answer any two of the following.

- a) In the engine system shown in figure 5(a), $l = 160$ mm and $b = 60$ mm. Knowing that the crank AB rotates with a constant angular velocity of 1000 r/min clockwise, determine the velocity of the piston P and the angular velocity of the connecting rod when (i) $\theta = 0$ (ii) $\theta = 90^\circ$. [06]
- b) A uniform rectangular plate has a mass of 5 kg and is held in position by three ropes as shown in figure 5(b). Knowing that $\theta = 30^\circ$, determine immediately after rope CF has been cut, (i) the acceleration of the plate (ii) the tension in ropes AD and BE. [06]
- c) Each the gears A and B has a mass of 2.4 kg and a radius of gyration of 60 mm, while gear C has a mass of 12 kg and a radius of gyration of 150 mm as shown in figure 5(c). A couple M of constant magnitude 10 Nm is applied to gear C. Determine [06]
- The number of revolutions of gear C required for its angular velocity to increase from 100 to 450 r/min.
 - The corresponding tangential force acting on gear A.
- d) The double pulley shown in figure 5(d) weighs 13.6 kg and has a centroidal radius of gyration of 165 mm. Cylinder A and block B are attached to cords that are wrapped on the pulleys as shown. The coefficient of kinetic friction between block B and the surfaces is 0.25. Knowing that the system is released from rest in the position shown, determine [06]
- The velocity of cylinder A as it strikes the ground.
 - The total distance that block B moves before coming to rest.

contd... 3

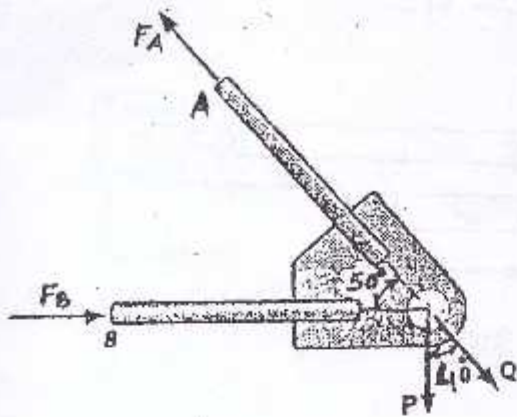


Fig. 1(a)

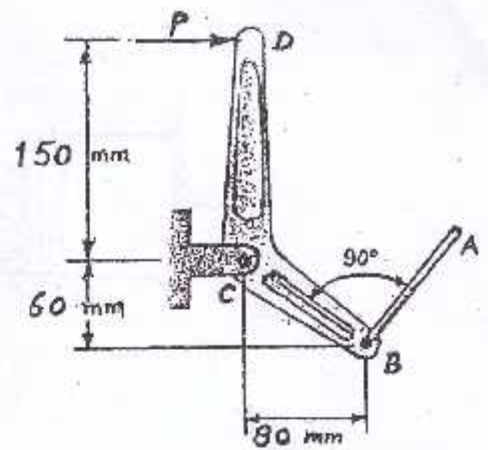


Fig. 1(b)

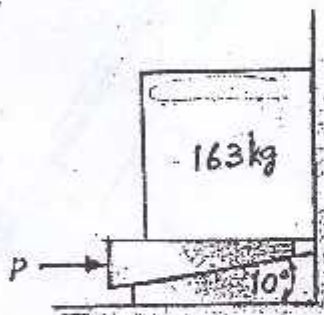


Fig. 1(c)

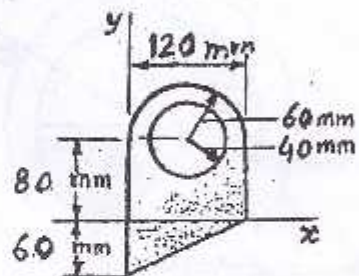


Fig. 2(a)

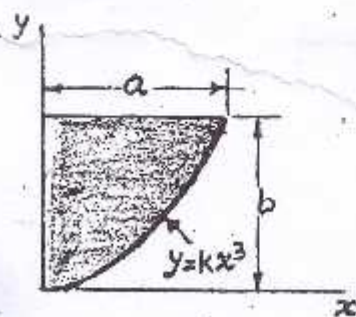


Fig. 2(b)

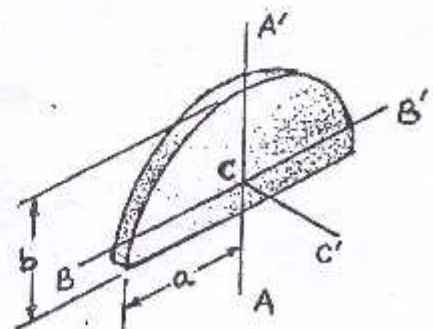
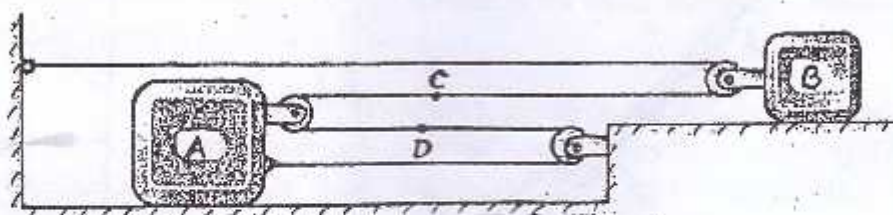
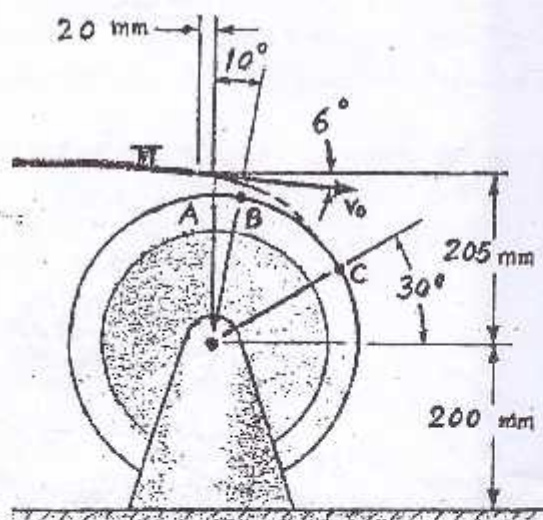
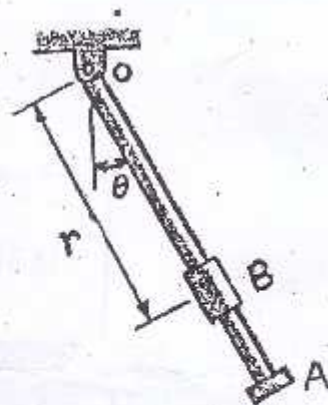
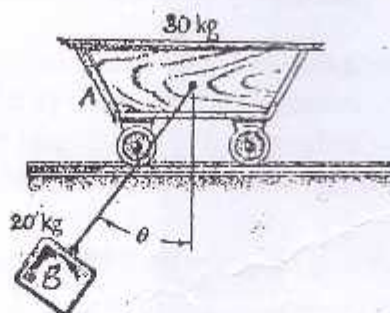


Fig. 2(c)

- 4 -

Fig 3(a)Fig. 3(b)Fig. 3(c)Fig. 4(a)

contd.

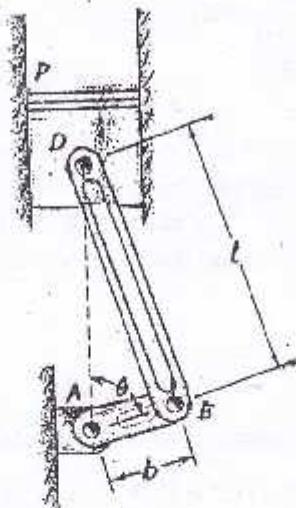


Fig. 5(a)

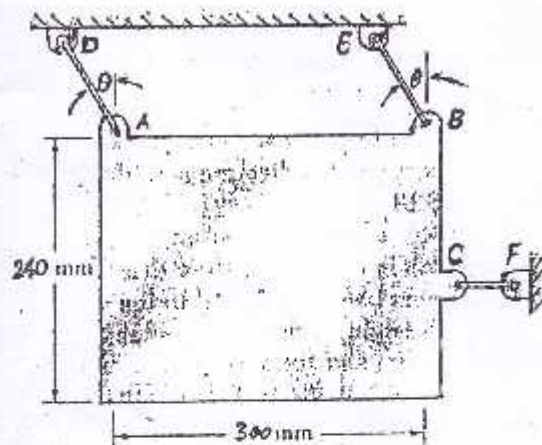


Fig. 5(b)

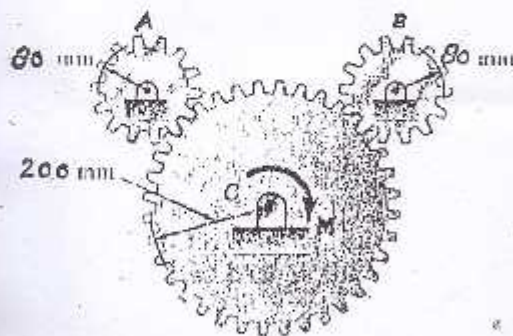


Fig. 5(c)

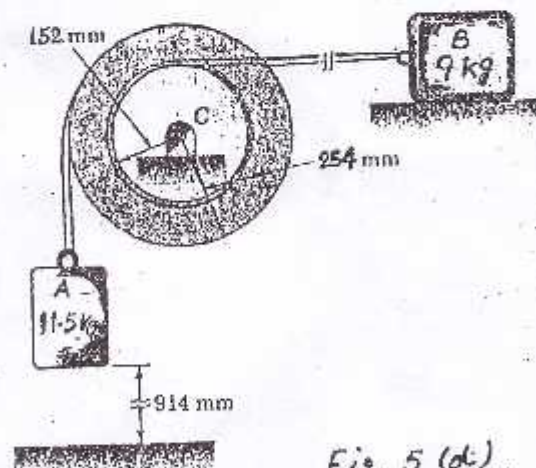


Fig. 5(d)

2014-15
B.TECH. /B.ARCH. (AUTUMN SEMESTER) EXAMINATION
ALL BRANCHES
APPLIED MECHANICS
ME-111

Maximum Marks: 60

Credits: 04

Duration: Three Hours

Attempt all the questions.

Use separate answer booklets for attempting section A and section B.

Assume suitable data if missing.

Notations used have their usual meaning.

SECTION A

Q.No.	Question	M.M.
1.(a)	Collars A and B are connected by a 1-m-long wire and can slide freely on frictionless rods (Figure-1). If a force $\mathbf{P} = (680 \text{ N})\mathbf{j}$ is applied at A , determine (a) the tension in the wire when $y = 300 \text{ mm}$, (b) the magnitude of the force Q required to maintain the equilibrium of the system.	(06)

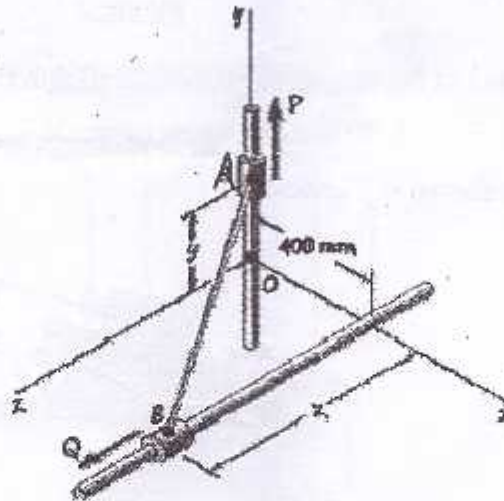


Figure-1

OR

Contd...2.

- 1.(a') Three cables are used to tether a balloon as shown (Figure-2). Determine the vertical force P exerted by the balloon at A knowing that the tension in cable AB is 259 N. (06)

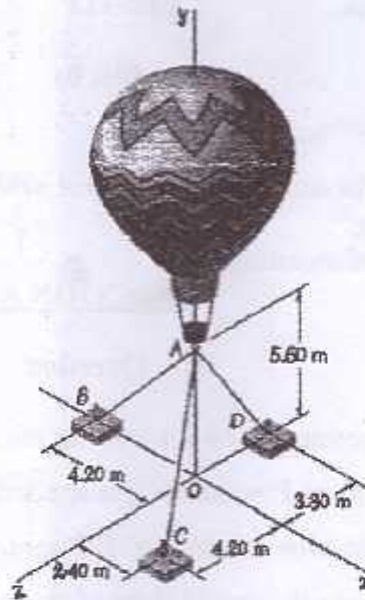


Figure-2

- 1.(b) The coefficients of friction are $\mu_s = 0.40$ and $\mu_k = 0.30$ between all surfaces of contact. Determine the force P for which motion of the 30-kg block is impending if cable AB is attached as shown in Figure-3. (06)

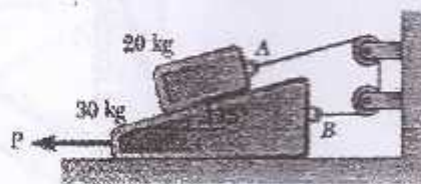


Figure-3

OR

- 1.(b') Determine the vertical force P which must be applied at G so that the linkage is in equilibrium for the position shown. (Figure-4) (06)

contd...3

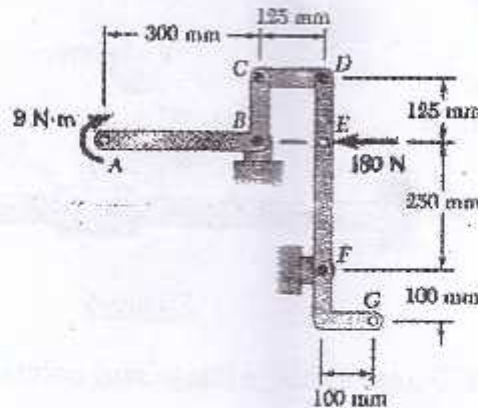


Figure-4

- 2.(a) The 18 kg block starts from rest and moves upward when constant forces of 20 N and 40 N are applied to supporting ropes (Figure-5). Neglecting the masses of the pulleys and the effect of friction, determine the speed of the block after it has moved 0.457 m. (06)

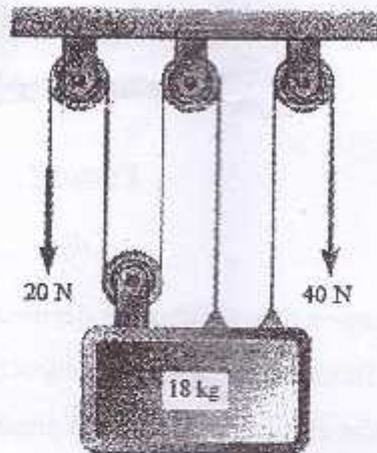


Figure-5

- 2.(b) A 1.8 kg collar can slide without friction along a horizontal rod and is in equilibrium at A when it is pushed 25 mm to the right and released from rest (Figure-6). The springs are undeformed when the collar is at A and the constant of each spring is 490 kN/m. Determine the maximum velocity of the collar. (06)

Contd... 4

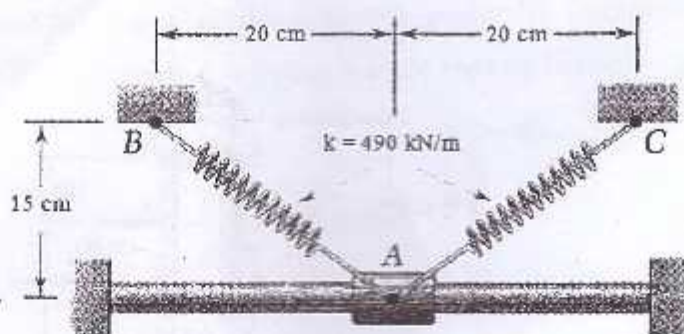


Figure-6

- 3.(a) The bent rod $ABCD$ rotates about a line joining points A and D with a constant angular velocity of 75 rad/s . Knowing that at the instant considered the velocity of corner C is upward, determine the velocity and acceleration of corner B . (Figure-7)

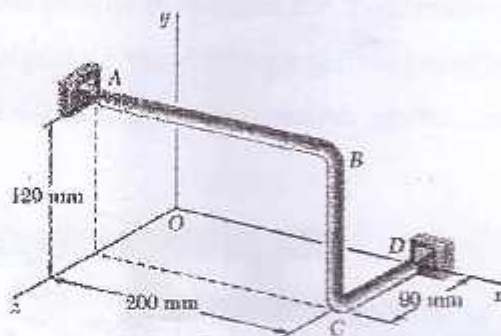


Figure-7

OR

- 3.(a') The angular acceleration of a flywheel is defined by the relation $\alpha = 30e^{-0.2t}$, where α and t are expressed in rad/s^2 and seconds, respectively. Knowing that $\theta = 0$ and $\omega = 0$ at $t = 0$, determine the angular velocity and angular coordinate of the particle when $t = 0.5 \text{ s}$.
- 3.(b) The motion of rod AB is guided by pins attached at A and B which slide in the slots shown (Figure-8). At the instant shown, $\theta = 40^\circ$ and the pin at B moves upward to the left with a constant velocity of 150 mm/s . Determine (a) the angular velocity of the rod, (b) the velocity of the pin at end A .

contd - 5.

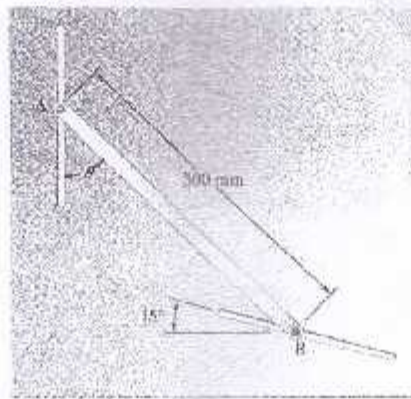


Figure-8

SECTION B

4. Determine the stresses in each rod of a composite section due to a compressive load of 2000 N and a temperature increase by 60°C . The composite section has two copper rods and one steel rod. Take length of each rod as 1000 mm. Diameter of each copper rod is 300 mm and the steel rod is 200 mm. (12)

$$E_s = 2 \times 10^5 \text{ N/mm}^2, E_{cu} = 1 \times 10^5 \text{ N/mm}^2$$

$$\alpha_s = 6 \times 10^{-6} / ^\circ\text{C}, \alpha_{cu} = 11 \times 10^{-6} / ^\circ\text{C}$$

The composite section has collars at both sides.

OR

- 4'. Determine the total volumetric strain in a cube of side 800 mm due to the following loads. (12)
- Load along the length = 1500 N (Tensile)
- Load along the thickness = 600 N (Compressive)
- Load along the width = 500 N (Tensile)
- Take $E = 2 \times 10^5 \text{ N/mm}^2$ and Poisson's ratio = 0.3
- 5.(a) Determine the shear force and bending moment in a simply supported beam of span 8 m with a central point load of 5kN and u.d.l. of intensity 2kN/m over the whole span. Draw SFD and BMD. (06)
- 5.(b) Determine the bending stress and shear stress in a beam of rectangular cross-section as per following data: (06)
- Width of the section = 500 mm
- Depth of the section = 1000 mm
- Max. B.M. = $5.25 \times 10^7 \text{ N-mm}$
- Max. S.F. = $1.8 \times 10^4 \text{ N}$

B.TECIL FIRST YEAR (AUTUMN SEMESTER) EXAMINATION

APPLIED CHEMISTRY
AC111

Maximum Marks: 60

Credits: 04

Duration: Three Hours

*Answer all the questions.**Notations used have their usual meaning.*

Q.No.	Question	M.M. [2×5]
1	Answer the following: (i) Principle of gravimetric analysis (ii) Chelometric titrations (iii) Primary and secondary standards (iv) Analyte and titrant (v) Requirements of a titrimetric method	
OR		
1'(a)	Write Beer Lambert's law and describe various terms involved A sample of iron in 1.0 cm cell showed an absorbance of 0.46 at 540 nm wavelength Find out the concentration of iron if absorptivity of the sample is $1.54 \text{ L. g}^{-1} \text{ cm}^{-1}$	[06]
1'(b)	Explain the followings: (i) Mechanism of ion-exchange chromatography (ii) Stationary and mobile phases	[04]
2(a)	Giving chemical equations, explain the water softening by zeolite process and list its limitations	[01]
2(b)	A sample of water on analysis gave the following results $\text{Ca}(\text{HCO}_3)_2 = 21.8 \text{ mg/L}$; $\text{Mg}(\text{HCO}_3)_2 = 18.6 \text{ mg/L}$; $\text{CaSO}_4 = 16.4 \text{ mg/L}$; $\text{MgCl}_2 = 10.6 \text{ mg/L}$; $\text{Fe}_2\text{O}_3 = 1.8 \text{ mg/L}$; $\text{Na}_2\text{SO}_4 = 3.6 \text{ mg/L}$ (a) Calculate temporary and permanent hardness of the water sample in mg/L . (b) Calculate the amount of lime and soda required to soften 10^5 litres of this water	[06]

Contd.....2.

OR

- 2' Write brief notes on the followings: [2.5×]
- (i) Sedimentation with coagulation
 - (ii) Break point chlorination
 - (iii) Boiler corrosion
 - (iv) Reaction of lime with impurities causing temporary hardness
- 3(a) Define gross and net calorific values. Describe the determination of calorific value of a solid fuel by bomb calorimeter. [05]
- 3(b) Describe Bergius process for the preparation of synthetic petrol [05]
- 4 Explain the followings: [2.5×]
- (i) Mechanism of boundary lubrication
 - (ii) Silicon fluids
 - (iii) Viscosity and viscosity index
 - (iv) Conditions where grease is used as lubricant
- 5 Write notes on the followings:
- (a) Mechanism of electrochemical corrosion by absorption of oxygen [04]
 - (b) Electrochemical series and its importance [03]
 - (c) Corrosion control by proper designing [03]
- 6(a) Give the preparation, properties and uses of any two of the following polymers: [3×2]
- (i) Polyesters
 - (ii) Buna N
 - (iii) PTFE
- 6(b) What is natural rubber? Give its limitations [02]
- 6(c) Distinguish between thermoplastics and thermosetting plastics [02]

2015-16
B.Tech All Brances (I SEMESTER) EXAMINATION
Atmospheric Chemistry
AC-308

Credits: 04

Duration: Three Hours

Maximum Marks: 60

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q.No.	Question	M.M.
1(a)	Enlist the various zones of the atmosphere and discuss the significance of stratosphere.	[5]
1(b)	What is photochemical smog? Write the photochemical reactions involved in the formation of photochemical smog.	[5]
OR		
1(a)	Write short notes on any two of the following alternative fuels: (i) P-Series (ii) Biodiesel (iii) CNG	[5]
1(b)	What is the importance of indoor air quality? Describe the factors affecting the indoor air quality.	[5]
2(a)	What is clean air act? Define criteria pollutants and discuss the sources and significance of carbon monoxide/sulphur dioxide.	[5]
2(b)	Define particulate matter and give its classification. Describe the effects of particulate matter on human health.	[5]
3(a)	Why the gaseous pollutants are monitored? How CO or NH ₃ are quantitatively estimated?	[5]
3(b)	Write a brief notes on any two of the followings: (i) Grab sampling and condensation (ii) Fourier Transform Infrared spectrometry	[2.5x2]

Contd.....2.

(iii) Atomic Absorption Spectrometry

- 4 (a) What is the principle of wet collectors? Explain cyclone scrubber method in air pollution control. [6]
- 4(b) Discuss any two of the followings in brief: [4]
- (i) Fabric filters
 - (ii) Venture scrubber
 - (iii) Electrostatic precipitator
- 5 What are natural cycles? Explain the carbon and nitrogen cycles in detail. [10]
- 6 (a) What is the significance of Green House effect? Describe the various regional impacts of global warming. [6]
- 6 (b) Discuss the formation and depletion of ozone. [4]
-

2015-2016

B.TECH./B.ARCH (AUTUMN SEMESTER) EXAMINATION
(ELECTRICAL/MECHANICAL/CIVIL/ELECTRONICS/COMPUTER/
CHEMICAL/PETRO-CHEMICAL ENGINEERING)

APPLIED MATHEMATICS - I

(AM - 101)

Credits: 05

Max Marks: 60

Duration: Three Hours

Note: Solve all questions.

1. (a) Determine the values of a, b for which the system of equations $3x - 2y + z = b$, $5x - 8y + 9z = 3$, $2x + y + az = -1$ has (i) a unique solution (ii) infinitely many solutions (iii) no solution.

- (b) Find the eigen values and eigen vectors of the matrix $A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ also

find the eigen values of $3A^3 + 4A^2 - 6A + 2I$.

OR

- (b') Find the characteristic equation of matrix $A = \begin{bmatrix} 4 & 3 & 1 \\ 2 & 1 & -2 \\ 1 & 2 & 1 \end{bmatrix}$ Hence find A^{-1} . [6,6]

2. (a) Find the pedal equation of the curve $r^n = a^n \cos n\theta$.

- (b) Trace the curve $y = \frac{x^2}{(1-x^2)}$ by discussing its salient features.

OR

- (b') Show that the asymptotes of the curve $x^3 - 2y^3 + xy(2x - y) + y(x - y) + 1 = 0$ cut the curve again in three points which lie on the line $x - y + 1 = 0$. [6,6]

3. (a) If $y = \frac{\sin^{-1} x}{\sqrt{1-x^2}}$, prove that $(1-x^2) \frac{dy}{dx} = xy + 1$. By applying Leibnitz theorem show that $(1-x^2)y_{n+1} - (2x+1)xy_n - x^2y_{n-1} = 0$

OR

- (a') Prove by Maclaurin's expansion that

$$\log \cosh x = \frac{1}{2}x^2 - \frac{1}{12}x^4 + \frac{1}{45}x^6 - \dots$$

- (b) (i) Test convergence of the series whose general term is

$$T_n = \frac{1}{\sqrt{n} + \sqrt{n+1}}$$

[5,7]

Contd.....2

-2-

- (ii) Test the convergence of the series

$$1 + \frac{2}{5}x + \frac{6}{9}x^2 + \frac{14}{17}x^3 + \dots \frac{2^n - 2}{2^n + 1}x^{n-1} + \dots$$

- 4 (a) Find the intrinsic equation of the parabola $y^2 = 4ax$.
 (b) Show that the volume of the solid generated by the revolution of the curve $y = \frac{a^3}{a^2 + x^2}$ about its asymptote is $\frac{1}{2}\pi^2 a^3$.

OR

- (b') Find the area of the surface formed by the revolution about the x-axis of an arch of cycloid $x = a(t + \sin t)$, $y = a(1 + \cos t)$.
 5. (a) Solve any two of the following differential equations
 (i) $(x^3 e^x - 2y^2)dx + 2xy dy = 0$
 (ii) $\frac{d^3 y}{dx^3} - 2\frac{dy}{dx} + 4y = x^2 + 4\sin x$
 (iii) $x^2 \frac{d^2 y}{dx^2} - x \frac{dy}{dx} + y = x + \log x$

- (b) Solve the following system of equations:

$$\frac{dx}{dt} + 2x + 3y = 0$$

$$\frac{dy}{dt} + 3x + 2y = 2e^{2t}$$

OR

- (b') A liquid in a test tube cools from 70°C to 60°C in 4 minutes, the room temperature being 30°C . Determine the temperature of the liquid as a function of time, and time taken in cooling down to 40°C .

2015 - 2016

B.TECH/B.ARCH. AUTUM (I SEMESTER) EXAMINATION
(ELECTRICAL/MECHANICAL/CIVIL/ELECTRONICS/COMPUTER/CHEMICAL/
PETRO-CHEMICAL ENGINEERING)

MATHEMATICS-I

(AM-111)

Credits: 04

MAXIMUM MARKS : 60

DURATION : THREE HOURS

Note : Answer all questions.

- Q.1 (a) Test the consistency and hence solve $x_1 + 2x_2 + x_3 = 2$, $3x_1 + x_2 - 2x_3 = 1$,
 $4x_1 - 3x_2 - x_3 = 3$, $2x_1 + 4x_2 + 2x_3 = 4$.

- (b) Find the eigen values and eigen vectors of the matrix $A = \begin{bmatrix} 3 & 1 & 4 \\ 0 & 2 & 6 \\ 0 & 0 & 5 \end{bmatrix}$

OR

- (b) State Cayley-Hamilton theorem. Verify the theorem for the matrix $A = \begin{bmatrix} 1 & 2 \\ -1 & 3 \end{bmatrix}$ and express $A^5 - 4A^3 + 8A^2 - 12A + 14$ as a linear polynomial in A . [7+8]

- Q.2 (a) Find the asymptotes of the curve $4(x^4 + y^4) - 17x^2y^2 - 4x(4y^2 - x^2) + 2(x^2 - 2) = 0$ and show that they pass through the points of intersection of the curve with the ellipse $x^2 + 4y^2 = 4$.

OR

- (a') Trace the curve $y = \frac{x^2 + 1}{x^2 - 1}$ mentioning its salient features.

- (b) (i) If $\cos^{-1}\left(\frac{y}{b}\right) = \log_e\left(\frac{x}{a}\right)^n$, show that $x^2y_{n+2} + (2n+1)xy_{n+1} + 2n^2y_n = 0$

- (ii) Express $\log(\sin x)$ in powers of $(x - \frac{\pi}{2})$ by Taylor's theorem. Write at least three non-zero terms. [7+8]

- Q.3 (a) Find the intrinsic equation of the curve $r = a(1 - \cos\theta)$

- (b) The hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ is revolved about x-axis. Find the volume cut off from one of two solids thus obtained by a plane perpendicular to x-axis and distance h from the vertex. [8+7]

- (b') Find the area of the surface formed by revolutions about x-axis of an arc of cycloid $x = a(t + \sin t)$, $y = a(1 + \cos t)$.

OR

- Q.4 (a) Solve any three of the following

(i) $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + 2y = x$

(ii) $\frac{d^2y}{dx^2} + 4y = \sin^2 x + x^3 e^x$

Contd.....2

-2-

$$(iii) \quad x^2 \frac{d^2 y}{dx^2} - x \frac{dy}{dx} - 3y = x^2 \log x$$

$$(iv) \quad 2x^2 \frac{d^2 y}{dx^2} + 7x \frac{dy}{dx} - 3y = x^2 + \frac{1}{x^2}$$

(b) Solve the simultaneous differential equation

$$\frac{dx}{dt} + 4x + 3y = t$$

$$\frac{dy}{dt} + 2x + 5y = e^t$$

OR

(b') A body falling from rest is subjected to the force of gravity and air resistance proportional to the square of the velocity. If the resistance is equal to the weight of the body when speed is b , show that the distance traveled by the body in t seconds is given by [29]

$$\frac{b^2}{g} \log \left(\cosh \frac{gt}{b} \right)$$

2015-16

B.TECH. (AUTUMN SEMESTER) EXAMINATION

(Civil/Chemical/ Computer/ Electrical/ Electronics/ Mechanical//Petro-Chemical/Arch. Engg.)

APPLIED PHYSICS-I

AP-101

Maximum Marks: 60

Credits: 03

Duration: Three Hours

Note: Answer all the questions. Symbols used have their usual meanings.

- 1(a) What are direct and indirect band gap semiconductors? Draw E vs. k diagrams and give four examples in each case. [5.0]
- 1(b) Define mobility of a charge carrier. Taking contribution of electrons and holes, obtain an expression for current density hence write electrical conductivity. [6.5]
- 1(c) A Si sample is doped with 10^{17} As atoms/cm³. Where is E_F relative to E_i at 300 K? [3.5]
(Given: $n_i = 1.5 \times 10^{10}$ cm⁻³ and $k_B = 1.38 \times 10^{-23}$ J/K)
- 2(a) What are the postulates of special relativity? Write down Lorentz transformation. Derive an expression for relativistic length contraction using Lorentz transformation. [6.0]
- 2(b) Write down Maxwell's equations. Considering travelling electromagnetic waves and using concept induced electric and magnetic field establish the relation: $c = 1/(\mu_0 \epsilon_0)^{1/2}$ [6.0]
- 2(c) An electron ($m_0 = 0.511$ MeV/c²) and a photon ($m_0 = 0$) both have momenta 2.00 MeV/c. Find total energy of each. [3.0]
- 3(a) Explain Compton effect? Obtain an expression for the wavelength shift, $(\lambda' - \lambda)$ when a photon is scattered by an electron at rest, i.e., $(\lambda' - \lambda) = (h/mc)(1 - \cos \phi)$. [8.0]
- 3(b) A 2 nm photon is scattered through an angle 60° by an electron at rest. Estimate the wave length of the scattered photon. [3.0]
- 3(c) What do you mean by pair production? Show that pair production cannot occur in free (empty) space [4.0]

OR

- 3'(a) What are continuous and characteristic X-rays? Briefly discuss the production mechanisms of these rays. Mention the approximate wavelength range of X-rays. [5.0]
- 3'(b) What are phase and group velocities? Show that the velocity of the wave group associated with a moving particle is always equal to the velocity of the particle [5.0]
- 3'(c) Discuss Heisenberg uncertainty principle. Mention various uncertainty relations you know and obtain qualitatively the uncertainty relation; $\Delta x \Delta p \geq \hbar$ [5.0]

Contd.....2.

- 4(a) Define expectation value of a physical quantity. Set up the time dependent form of Schrödinger equation and hence deduce its time independent (steady state) form. [9.0]
- 4(b) Write the normalized wave function of a particle trapped in a box L wide and hence find the probability of finding the particle in the box between $x=0$ and $x=L/n$ when it is in the n^{th} state. [6.0]

OR

- 4'(b) Electrons with energies of 0.5 eV are incident on a barrier 3.0 eV high and 0.10 nm wide. Find the approximate probability for these electrons to penetrate through the barrier. [6.0]

Some useful physical constants

$h=6.63 \times 10^{-34} \text{ J.s.}$	$k_B=1.38 \times 10^{-23} \text{ J/K.}$	$m_e=9.1 \times 10^{-31} \text{ kg.}$
$m_p=1.67 \times 10^{-27} \text{ kg.}$	$m(\text{O}_2)=32 \text{ amu.}$	$c=3 \times 10^8 \text{ m/s}$
$n(\text{Si})=1.5 \times 10^{16} \text{ m}^{-3}$	$q_e=1.6 \times 10^{-19} \text{ C.}$	$1 \text{ amu} = 1.66 \times 10^{-27} \text{ Kg}$

2015-16

B.TECH. (AUTUMN SEMESTER) EXAMINATION

(Civil/Chemical/ Computer/ Electrical/ Electronics/ Mechanical//Petro-Chemical/Arch. Engg.)

APPLIED PHYSICS

AP-111

Maximum Marks: 60

Credits: 04

Duration: Three hours

- Answer all the questions. Symbols used have their usual meanings.
- Some useful physical constants are given at the end of the question paper.

1(a) Discuss Hall effect in the case of a p-type semiconducting sample. Obtain an expression for majority carrier concentration in terms of measurable parameters in the given sample. What are the important applications of Hall probe? 6.5

OR

1(a') Define Fermi level E_F . Derive an expression for carrier concentration in conduction band at equilibrium for a semiconductor and explain shifting of Fermi level with the doping concentration. 6.5

1(b) Find the resistivity of intrinsic Ge at 300 K. (Given: $m_n^* = 0.55 m_0$, $m_p^* = 0.37 m_0$, $E_g = 0.67$ eV, $\mu_n = 3900$ cm²/V.s and $\mu_p = 1900$ cm²/V.s) 3.5

2(a) Define numerical aperture and obtain an expression for numerical aperture in the case of a step index fiber in terms of refractive indices of core and cladding. 5.0

2(b) What are the advantages of optical fiber communication system over conventional communication system? 3.0

2(c) Calculate angle of acceptance for step index silica fiber having refractive indices 1.48 and 1.42 for core and cladding respectively. 2.0

3(a) Define the terms; induced absorption, spontaneous emission and stimulated emission. Discuss construction and working of He-Ne laser with the help of suitable diagrams. Compare this laser with the ruby laser. 6.5

3(b) If the angular spread of a laser beam is ideally diffraction limited and is given by $\theta_0 = 1.22\lambda/D$, where θ_0 can be considered the angle between a line parallel to the center of the beam and a line parallel to the "edge" of the beam, λ is the wavelength of laser and D is the diameter of the rod. For a ruby laser of diameter 1 cm and wavelength 6943 Å, what would be the radius of a spot projected on a screen placed at a distance of 1 km? 3.5

4(a) With the help of suitable diagram discuss the production mechanism of X-rays and explain the term: Duane-Hunt limit, continuations and characteristic X-rays. 7.0

4(b) An X-ray photon having frequency 1.5×10^{19} Hz undergoes Compton scattering 3.0

Contd.....2.

with an electron and emerges with a frequency of 1.2×10^{19} Hz. Find the kinetic energy (in joules) imparted to the electron.

OR

- 4'(a) Explain the terms-phase velocity and group velocity. Obtain the expression for group velocity, $v_g = (dw/dk)$ and show that the group velocity, v_g associated with a moving particle is always equal to the velocity of the particle, v . 7.0
- 4'(b) Find the shortest wavelength present in the radiation from an x-ray machine whose accelerating potential is 50,000 V. 3.0
- 5(a) Explain the physical significance of the wave function, Ψ and discuss the necessary conditions for it to be physically acceptable. 3.0
- 5(b) Write the steady state form of Schrodinger equation and solve it for the energy and the normalized wave function of a particle trapped in a box (infinite square potential well) L wide. Plot the wave function and the corresponding probability densities for the three lowest quantum states. 7.0
- 6(a) Discuss the physical significance of Fermi energy. Use the expression for number of quantum states, $g(\epsilon)d\epsilon$ of free electrons in metals to obtain an expression for Fermi energy. Show that average electron energy at 0 K is $3/5 E_F$. 7.0
- 6(b) Draw a curve showing the distribution of electron energies in a metal at various temperatures. Explain why the electrons in a metal do not contribute to its specific heat? 3.0

OR

- 6'(a) Obtain classical result on specific heats of solids at constant volume and give its limitations. Discuss Einstein's explanation of specific heats of solids and show that this result reduces to classical result at higher temperatures. 7.0
- 6'(b) Find the Fermi energy of tungsten on the assumption that each tungsten atom contributes two free electrons to the electron gas. The density of tungsten is 19.3 g cm^{-3} and its atomic mass is 183.8 amu. 3.0

Some Useful Physical Constants

$$\begin{array}{ll}
 h=6.63 \times 10^{-34} \text{ J.s.} & k_B=1.38 \times 10^{-23} \text{ J/K,} \\
 m_e=9.1 \times 10^{-31} \text{ kg,} & m_p=1.67 \times 10^{-27} \text{ kg, } m(\text{O}_2)=32 \text{ amu, } c=3 \times 10^8 \text{ m/s} \\
 n(\text{Si})=1.5 \times 10^{16} \text{ m}^{-3} & q_e=1.6 \times 10^{-19} \text{ C, } 1 \text{ amu} = 1.66 \times 10^{-27} \text{ kg}
 \end{array}$$

2015-16
B.ARCH. FIRST SEMESTER EXAMINATION
ARCHITECTURAL DRAWING - I
AR-103

Maximum Marks: 40

Credits: 04

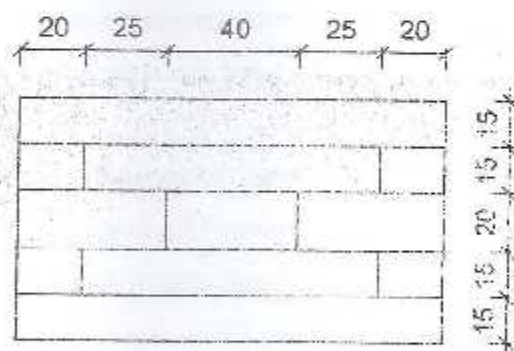
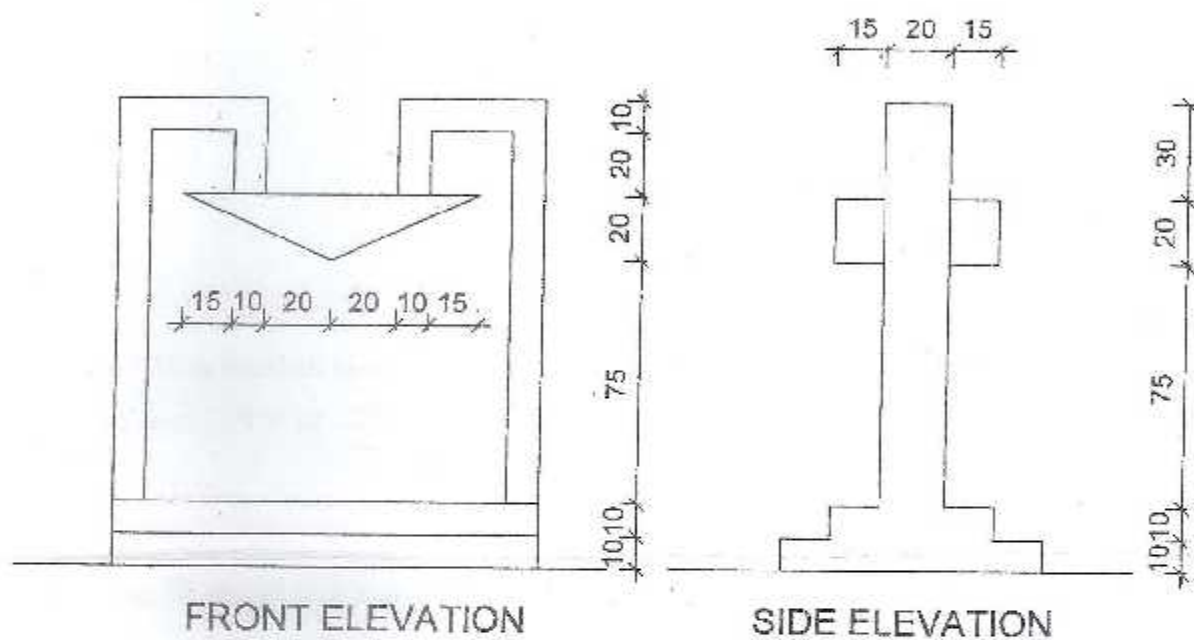
Duration: Three Hours

*Answer all the questions.**Assume suitable data if missing.**Neat and good drafted drawings will be credited more.*

Q.No.	Question	M.M.
1	Represent the followings:-	
	a) An air craft in side elevation.	3
	b) Plants in elevation.	3
	c) Wooden Texture (in box size 80 mm X 60 mm)	2
	d) Brick work in elevation (in box size 80 mm X 60 mm)	2
2	A square prism of base 30 mm side and height 65 mm has its axis inclined at 45° to H.P.. It has an edge of its base on H.P., which is inclined at 30° to V.P.. Draw its orthographic projections.	10
OR		
2'	A regular pentagonal pyramid with the sides of its base 30 mm and height 80 mm rests on an edge of the base. The base is tilted until its apex is 50 mm above the level of the edge of the base on which it rests. Draw orthographic projection of the pyramid when the edge on which it rests, is parallel to the V.P. and the apex of the pyramid is towards V.P..	10
3	A cylinder of base diameter 50 mm and height 60 mm is resting on ground on its base. A circular hole of diameter 40 mm is cut through the cylinder. The axis of the hole is horizontal and intersect the axis of the cylinder at 25 mm above base of cylinder. Draw the development of surface of truncated cylinder.	10
4	Draw isometric view of the object shown in figure - 1.	10

Contd.....2.

- 2 -



(All Dimensions are in mm)

FIGURE - 1

2015-16

**B.ARCH. (AUTUMN SEMESTER) EXAMINATION
B. ARCH I- YEAR
PRINCIPLES & PHILOSOPHY OF ARCHITECTURE
AR-112**

Maximum Marks: 60

Credits: 04

Duration: Three Hours

*Answer all the questions.**Draw sketches to support your answer.*

Q.No.	Question	M.M.
1	Explain the need of architecture in the present scenario and what is the role of an architect in shaping a society?	[10]
2	What are the principles of architectural design, explain with figure the different types of hierarchy?	[10]
3	What are the indispensable elements of architectural design, explain with sketches how lines are employed in any architectural symphony?	[10]
OR		
3'	Explain the City of Chandigarh as a remarkable work of Le Corbusier?	
4	Explain with neat sketches, how mathematics as a subject plays an important in architecture from ancient time?	[15]
OR		
4'	How do physics be germane in architecture, explain with figure, what are the various important applications of physics in building industry?	
5	Explain the basic philosophy of Zaha Hadid and how does she incorporates her philosophy in designing the buildings?	[15]

AUTUMN 2015-16
B.TECH. (WINTER SEMESTER) EXAMINATION
ELECTRONICS/COMPUTERS/ELECTRICAL/MECHANICAL/CIVIL/CHEMICAL/
PETROCHEMICAL
ENVIRONMENTAL STUDIES
CE111

Maximum Marks: 60

Credits: 04

Duration: Three Hours

*Answer all the questions.**Assume suitable data if missing.**Notations used have their usual meaning.*

Q.No.	Question	Marks
1(a)	What is biodiversity? Explain any two levels at which biodiversity can be determined.	[05]
1(b)	Write short notes on any two of the following <ul style="list-style-type: none"> i. Values of biodiversity ii. Role of economy, environment and society in sustainable developments iii. Rain Water Harvesting 	[05]
2(a)	Differentiate between the exponential and the logistical population growth rate and explain the importance of carrying capacity.	[05]
2(b)	What is the role of Information Technology on environment and human health	[05]
OR		
2'(b)	Briefly discuss the disaster mitigation plan for any natural disaster.	[05]
3(a)	Discuss the energy flow concept in ecological pyramid. What is ecological succession in ecosystem?	[05]
3(b)	What are different water quality parameter? What are persistent organic pollutants and there health effects on humans?	[05]
4(a)	Suggest a water treatment scheme for ground water having hardness. Briefly discuss its each unit.	[05]

OR

Contd.....2.

- 4'(a) Draw typical wastewater treatment scheme for domestic sewage. [05]
- 4(b) What are different functional elements of solid waste management? Explain any disposal technique for municipal solid waste. [05]
- 5(a) Explain the aims and Objectives of Air (Prevention and Control of Pollution) Act, 1981? Also briefly describe its important features. [05]

OR

- 5'(a) What is Global Warming? How it is responsible for Climate Change? [05]
- 5(b) What is ozone ^{layer} and where is it in the atmosphere and how it is formed in the atmosphere? [05]
- 6(a) Discuss renewable and nonrenewable sources of energy? And write a short note on alternate energy sources of energy? [05]
- 6(b) Explain the aims and Objectives of Forest Conservation Act, 1980? Also briefly describe its important features. [05]

OR

- 6'(b) What is Acid rain? Also mention its causes and effects on environment. [05]
-

B.Tech/ B. Arch Autumn (I SEMESTER) EXAMINATION
(Civil/Electrical/Electronics/Computer/Chemical/Petro-Chemical & Mechanical)
BASIC ELECTRICAL ENGINEERING (EE-101)

(3462)

Maximum Marks: 60

Credit: 03

Duration: Three Hours

*Answer all the questions.**Assume suitable data if missing.**Notations used have their usual meaning.*

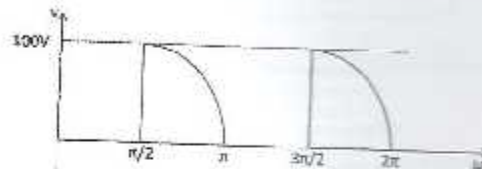
Q.No.

Question

M.M.

- 1(a) Find the Average value and RMS value of the following waveform:

[06]



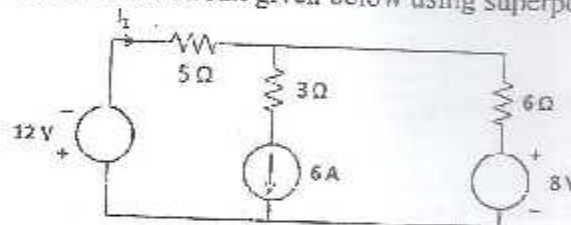
- 1(b) Using phasor diagram, obtain the relationship between line voltage and phase voltage for a star connected system.

[06]

OR

- 1* Determine the current I_1 in the circuit given below using superposition theorem.

[12]



- 2(a) What are different types of magnetic losses? How can they be minimized?

[06]

- 2(b) The no-load current of a transformer is 4 A at 0.25 p.f. when supplied at 250 V, 50 Hz. The number of turns on the primary winding is 200. Calculate:

[06]

- Flux in the core
- The core loss
- Magnetizing current

OR

- 2* A magnetic circuit shown in figure below is constructed of wrought iron. The cross section of central limb is 6 cm^2 and each outer limb is 4 cm^2 . If the coil is wound with

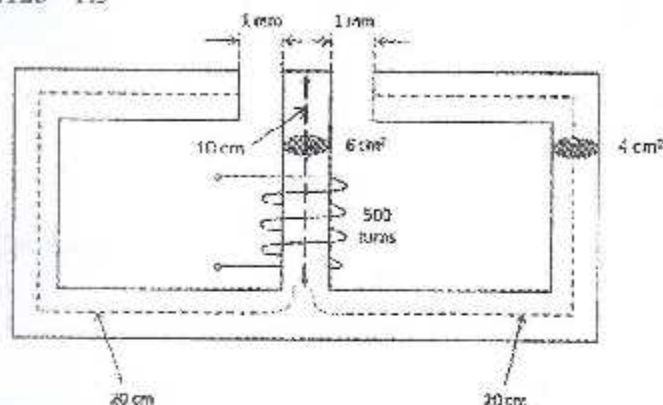
[12]

Contd.....2.

500 turns, calculate the exciting current required to setup a flux of 0.9 mWb in the central limb. BH curve of wrought iron are:

H (AT/m) : 500 2000

B (Wb/m²) : 1.125 1.5



3(a) Why is single phase induction motor not self-starting? Discuss any one method of starting a single phase induction motor. [06]

3(b) A three phase 50 Hz, 4 pole induction motor has an induced emf in the rotor with a frequency of 2 Hz, calculate: [06]

- (i) Synchronous speed
- (ii) Slip
- (iii) Speed of the motor

OR

3*(a) Explain principle of operation of 3 phase induction motor. [06]

3*(b) A three phase 16 pole alternator has a star connected winding with 144 slots and 10 conductors per slot. The flux per pole is 0.03 Wb sinusoidally distributed and the speed is 375 RPM. Calculate: [06]

- (i) The frequency
- (ii) The line induced emf

4(a) Explain the principle of operation and application of moving coil instruments [06]

4(b) With the help of neat diagram explain the working of induction type energy meter. [06]

5(a) Draw and explain the single line diagram of power system [06]

5(b) Classify hydroelectric power plant according to: [06]

- (i) Head
- (ii) Load
- (iii) Plant capacity
- (iv) Water flow regulation

B.TECH. (AUTUMN SEMESTER) EXAMINATION
 (Civil/Electrical/Electronics/Computer/Mechanical/Petrochemical/Chemical)
Basics of Electrical & Electronics Engineering
EE-111 (Part A & Part B)

Maximum Marks: 60

Credits: 04

Duration: Three Hours

*Answer all the questions.**Assume suitable data if missing.**Notations used have their usual meaning.**Part A (Q1 & 2) and Part B (Q3 & 4) are to be answered in separate copies.*

Q.No.

Question

M.M.

PART AI(a) *State* the following theorems for AC network:

(a) Thevenin's theorem.

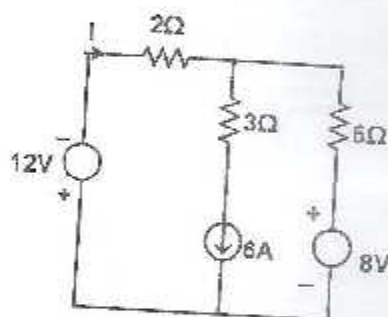
[05]

(b) Norton's theorem.

OR

I(a') Determine the current 'I' in the circuit shown *using* the superposition theorem:

[05]



I(b) In star connection by using Phasor diagram show that:

[05]

$$|V_{ab}| = |V_{bc}| = |V_{ca}| = V_L = \sqrt{3} V_P$$

I(c) What are hysteresis and eddy current losses? How they can be minimized?

[05]

OR

I(c') Draw exact equivalent circuit of the transformer referred to the primary. Also, draw the approximate equivalent circuit of the transformer referred to the primary as well as secondary.

[05]

Contd.....2.

- 2(a) Explain the principle of operation of a three-phase induction motor. [05]
- 2(b) With the help of diagram, explain the construction and principle of operation of repulsion type MI instrument. [05]

OR

- 2(b') With the help of diagram, explain the driving system and moving system of the induction type single-phase energy meter. [05]
- 2(c) How the hydroelectric power plant generates electricity? Write the factors that should be considered for selecting the site of hydroelectric power plant. Also, write its advantages. [05]

PART B (to be answered in a separate copy)

- 3(a) Explain the current equation of PN junction diode. [04]
- 3(b) a) For the Zener diode network of Fig. 3(b), determine V_L , V_R , I_Z , and P_Z . [06]
- b) Repeat part (a) with $R_L = 3 \text{ k}\Omega$.

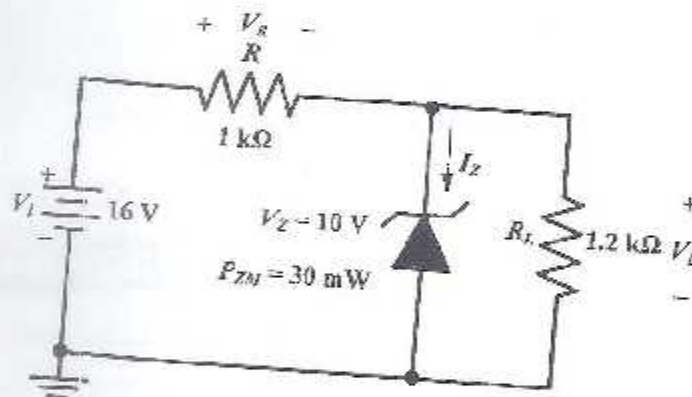


Fig. 3(b)

OR

- 3(b)' Determine V_C and V_B for the network of Fig. 3(b)'. [06]

Contd.....3.

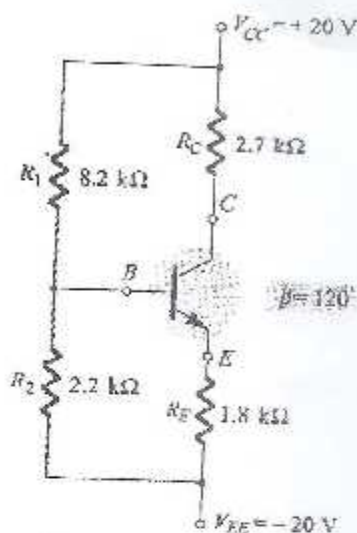


Fig. 3(b)

- 3(c) Draw the circuit diagram of a center-tapped full-wave rectifier circuit, indicating the direction of current paths during positive and negative half cycles of input. Explain its operation and determine its peak inverse voltage. [05]
- 4(a) Explain the construction, working and characteristics of an n-channel enhancement-type MOSFET. [05]
- 4(b) What are the different characteristics of an ideal operational amplifier? Also, explain the significance of virtual ground in an operational amplifier. [04]
- 4(c) Describe the integrator and differentiator circuit using op-amp. [06]
- OR
- 4(c)* Design an operational amplifier circuit that will produce output voltage: [06]
- $$V_o = 0.5V_1 - 2V_2$$

2015-2016

B.ARCH/ B.TECH AUTUMN (I SEMESTER) EXAMINATION
(ELECT/MECH/CIVIL/CHEM/ELECTRONICS/COMPUTER/
PETRO-CHEMICAL ENGINEERING)

ENGLISH

(EN - 101)

Credits: 04

Duration: Three Hours

Max Marks: 60

Note: Answer all questions.

UNIT - I

1. (a) Read the passage and answer the question that follow:

[5x2=10]

Our need for water is constantly increasing. There is an automatic increase due to population growth, while the overall improvement of living standards, the fight against hunger through the irrigation of more land for food growing, and the creation and expansion of new industries, all foretell the need for even greater water supplies throughout the world. Though it is difficult to calculate the exact amount, it is safe to say that in 20 years time the demand for water will be roughly double. Faced with such a situation it is obvious that we should search as widely as possible and with every available means for sources of fresh water that seem to be the least costly. But where do these sources exist? Only a sustained and co-ordinated programme of scientific observation and research in hydrology will tell us the answer.

Underground water reserves are much larger than those on the surface, but as they are unseen we tend to underestimate them. It is virtually important that we make use of these underground reserves, but never haphazardly. For example, where does the water come from which we find in one or another of the underground water-bearing layers? How does it move? How is it renewed? What are the laws of hydrogeology? Despite the immense progress of recent years, all these questions have still not been fully answered.

- (i) Hydrology is the study of:

[02]

(a) Electricity

(b) Water resources

(c) Gases

(d) None of the above

- (ii) Give two reasons for increasing water consumptions?

[02]

- (iii) In order to find fresh water the author recommends the study of?

[02]

- (iv) The author continues .. against misuse of what kind of reserves?

[02]

- (v) Hydrogeology is the study of what feature?

[02]

- (b) Write a summary of the passage given above.

[10]

UNIT - II

2. Discuss the chief tenets of 'Animalism' as visioned by Old Major?

OR

Write a brief character sketch of Boxer.

[05]

Contd.....2

3. Give a detailed description of the year 802701 AD?

OR

What kind of people were the Marlocks? Elaborate

[05]

UNIT – III

4. Write the process of making a power point presentation.

[10]

OR

Write a report, on the celebration of Sir Syed Day in your Hall.

OR

Write a report on the celebration of Eid Milad-un-Nabi in your Hall.

5. Read the following passage and write a précis of the same:

[05]

What is the nature of the scientific attitude, the attitude of the man or woman who studies and applies physics, biology, chemistry, geology, engineering, medicine or any other science?

We all know that science plays an important role in the societies in which we live. Many people believe, however, that our progress depends on two different aspects of science. The first of these is the application of the machines, products and systems of applied knowledge that scientists and technologists develop. Through technology, science improves the structure of society and helps man to gain increasing control over his environment. New Fibres and drugs, faster and safer means of transport, new systems of applied knowledge (psychiatry, operational research etc) are some examples of this aspect of science.

The second aspect is the application by all members of society, from the government official to the ordinary citizen, of the special methods of thought and action that scientists use in their work.

First of all, it seems that a successful scientist as full of curiosity he wants to find out how and why the universe works. He usually directs his attention towards problems which he notices have no satisfactory explanation and his curiosity makes him look for underlying relationships even if the data available seem to be unconnected. Moreover, he is a good observer, accurate, patient and objective and applies persistent and logical thought to the observations he makes.

He is sceptical – he does not accept statements which are not based on the most complete evidence available and therefore rejects authority as the sole basis for truth.

(approximately 262 words)

UNIT – V

6. Rewrite the following paragraph, putting all the ^{verb}s into the Simple Past Tense:

[05]

The geochemist goes to sea in a ship equipped with special pipes. Technicians then push these pipes through thousands of feet of water until the strike the bottom of the ocean. Then they drive the pipes into the sea-bottom and when they bring them up again they are full of mud.

7. Write an essay on any one of the following topics in about 300 words:

[10]

(i) Humanoids : The new species

(ii) Internet and knowledge distribution to the marginalized.

2015-16
B.TECH. (AUTUMN SEMESTER) EXAMINATION
ALL BRANCHES
THERMAL SCIENCES
ME 101

Maximum Marks: 60

Credits: 04

Duration: Three Hours

*Answer all the questions.**Assume suitable data if missing.**Notations used have their usual meaning.*

Q.No.	Question	M.M.
1(a)	Differentiate between: (i) Path function and point function (ii) 2-stroke and 4-stroke engine	[04]
1(b)	A new scale $^{\circ}\text{N}$ of temperature is divided in such a way that the ice point is 5°N and the steam point is 20°N . Derive an expression between $^{\circ}\text{N}$ and $^{\circ}\text{C}$. What is the temperature reading on this new scale when the temperature is 150°C ?	[04]
1(c)	A vacuum gage shows that the pressure in a closed gas chamber is 0.1 bar (vacuum). The pressure of the atmosphere is measured as 760 mm by a column of mercury. Find in bars, the absolute pressure within the chamber.	[04]
2(a)	A balloon of flexible material is to be filled with air from a storage bottle until it has a volume of 0.9 m^3 . The atmospheric pressure is $1.013 \times 10^5 \text{ N/m}^2$. Determine the work done by the system comprising the air initially in the bottle, given that the balloon is light and requires no stretching. Also explain what would be the effect on work done by air if the balloon is stretchable.	[06]
2(b)	Air passes through a gas turbine system at the rate of 4.5 kg/s . It enters the turbine system with a velocity of 90 m/s and a specific volume of $0.85 \text{ m}^3/\text{kg}$. It leaves the turbine system with a specific volume of $1.45 \text{ m}^3/\text{kg}$. The exit area of the turbine system is 0.038 m^2 . In its passage through the turbine system, the specific enthalpy	[06]

Contd.....2.

of the air is reduced by 200 kJ/kg and there is heat loss of 40 kJ/kg. Determine:

- i. The inlet area of the turbine
- ii. The exit velocity of the air
- iii. The power developed by the turbine system in kilowatts.

OR

2'(a) Derive Steady Flow Energy Equation for a control volume. [06]

2'(b) A 100 mm diameter vertical cylinder, closed by a piston, contains a combustible mixture at a temperature of 15 °C. The piston is free to move and its mass is such that the mixture pressure is $240 \times 10^3 \text{ N/m}^2$; the upper surface of the piston is exposed to the atmosphere. The mixture is ignited. As the reaction proceeds, the piston moves slowly upwards and heat transfer to the surroundings takes place. When the reaction is complete and the temperature of the contents has been reduced to the initial value, 15 °C, it is found that the piston has moved upwards a net distance of 85 mm and that the magnitude of the heat transfer to the surroundings is 4 kJ. Evaluate the increase in the energy of the contents of the cylinder. [06]

3(a) What are the limitations of a Throttling Calorimeter. Explain the working of a Separating and Throttling Calorimeter with the help of a property diagram. [06]

3(b) The properties of a certain gas are related by

$$pv = 310(t+273)$$
 and

$$u = u_0 + 0.84t$$
 where p is in N/m^2 , v in m^3/kg , t in °C and u in kJ/kg. [06]

A cylinder fitted with a piston contains 0.02 m^3 of this gas at a pressure of $350 \times 10^3 \text{ N/m}^2$ and a temperature of 80 °C. As the gas expands to a lower pressure the work done by the gas is 2900 N-m and the heat transfer from the gas is $1.9 \times 10^3 \text{ J}$.

- (a) Determine the temperature of the gas after expansion.
- (b) If the gas undergoes an adiabatic process between the same end states, evaluate the work done by the gas in this case.

OR

3'(a) A rigid vessel contains 1 kg of a mixture of saturated water and saturated steam at a pressure of $140 \times 10^3 \text{ N/m}^2$. When the mixture is heated, the state passes through the critical point. Evaluate: [08]

Contd.....3.

- (i) The volume of the vessel
- (ii) The mass of liquid and of vapour in the vessel initially
- (iii) The temperature of the contents of the vessel when the pressure has risen to $30 \times 10^6 \text{ N/m}^2$
- (iv) The heat transfer required to produce the final state (i).

3(b) Define pure substance and state 2-property rule. [04]

4(a) Show that violation of Kelvin-Planck statement leads to the violation of Clausius statement and vice-versa. [04]

4(b) A reversible heat engine operates between two systems at constant temperatures of 600°C and 40°C . The engine drives a reversible refrigerator which operates between systems at constant temperatures of 40°C and -20°C . The heat transfer to the heat engine is 2000 kJ and the net work output of the combined engine-refrigerator plant is $350 \times 10^3 \text{ N m}$. [08]

(i) Evaluate the heat transfer to the refrigerant and the net heat transfer to the system at 40°C .

(ii) Reconsider (i), given that the efficiency of the heat engine and the coefficient of performance of the refrigerator are each 40 % of their respective maximum possible values.

OR

4' In a refrigerating plant, the states of the working fluid (Freon-12) between the various components are as follows. [12]

Evaporator and compressor: wet vapour at a temperature of -15°C .

Compressor and condenser: dry saturated vapour at a temperature of 30°C .

Condenser and expansion valve: saturated liquid at a temperature of 30°C .

Expansion valve and evaporator: wet vapour at a temperature of -15°C .

The heat transfer rate from the Freon in the condenser is $1.5 \times 10^3 \text{ J/s}$ and the power required to compress the Freon is 310 W . All heat transfers to the atmosphere, and also fluid velocities, may be assumed to be negligible.

Sketch the cycle on an enthalpy-pressure diagram and using the data given below,

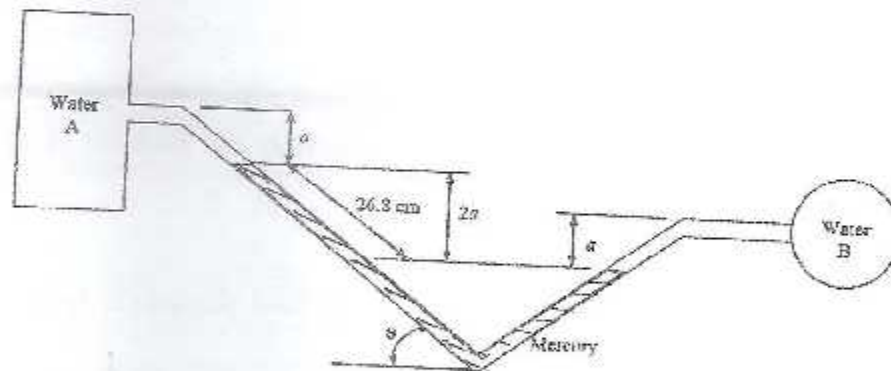
calculate:

- the mass flow rate of the Freon in kg/s
- the heat transfer rate of the Freon from the cold region
- the enthalpy of the Freon after the expansion valve
- the enthalpy and dryness fraction of the Freon at the entry to the compressor
- the coefficient of performance

Extract from table of properties of Freon-12:

Pressure 10^6 N/m^2	Saturation temperature $^{\circ}\text{C}$	Specific enthalpy 10^3 J/kg	
		Saturated liquid	Saturated vapour
0.1825	-15	22.3	181.0
0.745	30	64.6	199.6

- 5(a) Two water tanks are connected to each other through a mercury manometer with inclined tubes, as shown in figure. If the pressure difference between the two tanks is 20 kPa, calculate 'a' and 'θ'. [08]



- 5(b) Sketch the Brayton cycle on P-V and T-S diagram and show in the relevant diagram, the heat supplied and work done in various processes. [04]

2015-16
B.TECH./B. ARCH. AUTUMN SEMESTER
(I SEMESTER EXAMINATION)
APPLIED MECHANICS
(ME-111)

Maximum Marks: 60

Credits: 04

Duration: Three Hours

NOTE: Answer all the questions from Section A & Section B.
Use separate answer sheet for both the sections.

Q. No.

SECTION-A

M.M.

- 1(a) A hand truck shown in Fig. 1 is used to move two kegs, each of mass 40 kg. [8]
Neglecting the mass of the hand truck, determine (a) the vertical force P that should be applied to the handle to maintain equilibrium when $\alpha = 35^\circ$, (b) the corresponding reaction at each of the two wheels.

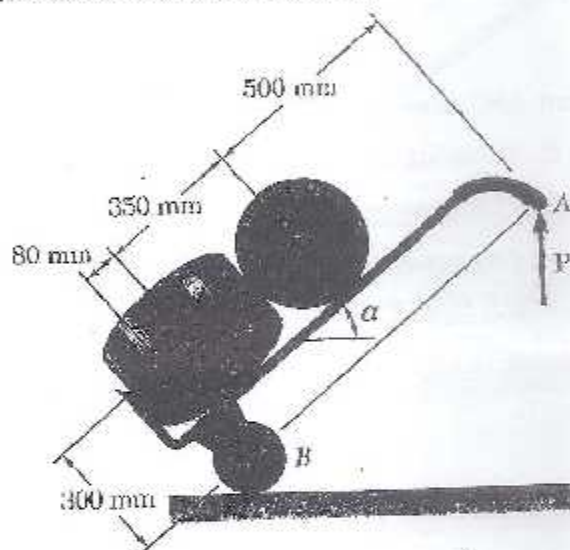


Fig. 1

- 1(b) Determine the resultant of the forces shown in Fig. 2. [4]

OR

- 1(b)' A crate of mass 80 kg is held in the position shown in Fig. 3. Determine (a) the moment produced by the weight W of the crate about E , (b) the smallest force applied at B that creates a moment of equal magnitude and opposite sense about E . [4]

Contd.....2.

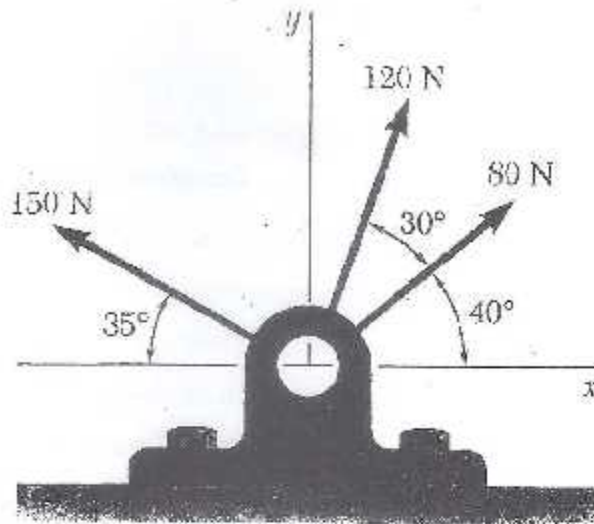


Fig. 2

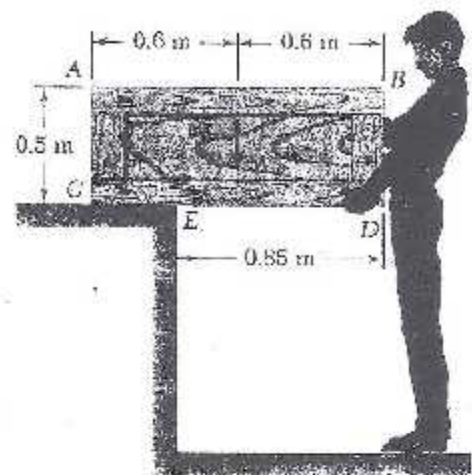


Fig. 3

OR

- 1'(a) The machine part ABC shown in Fig. 4 is supported by a frictionless hinge at B and a 10° wedge at C . Knowing that the coefficient of static friction at both surfaces of the wedge is 0.20, determine (a) the force P required to move the wedge, (b) the components of the corresponding reaction at B . [6]
- 1'(b) Determine the vertical force P that must be applied at G to maintain the equilibrium of the linkage shown in Fig. 5. [6]

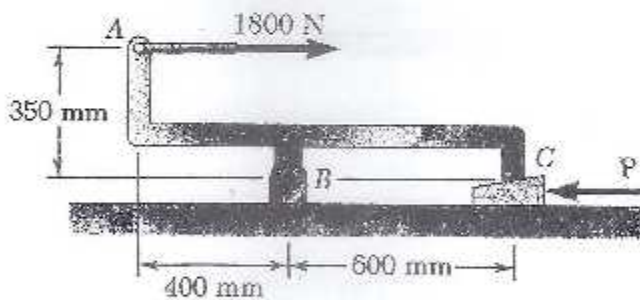


Fig. 4

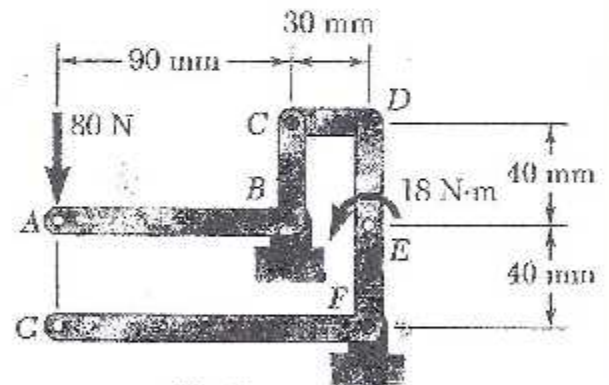


Fig. 5

- 2 The masses of blocks A , B , C and D are 9 kg, 9 kg, 6 kg and 7 kg, respectively. [12]
Knowing that a downward force of magnitude 120 N is applied to block D , determine (a) the acceleration of each block, (b) the tension in cord ABC . Neglect

Contd.....3.

the weights of the pulleys and the effect of friction (Refer Fig. 6).

- 3 Rod AB moves over a small wheel at C while end A moves to the right with a constant velocity of 500 mm/s . At the instant shown in Fig. 7, determine (a) the angular velocity of the rod, (b) the velocity of end B of the rod. [12]

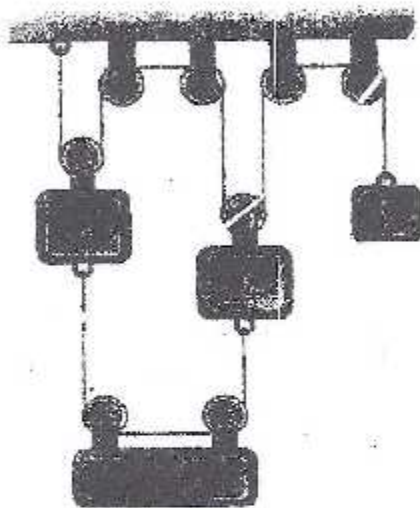


Fig. 6

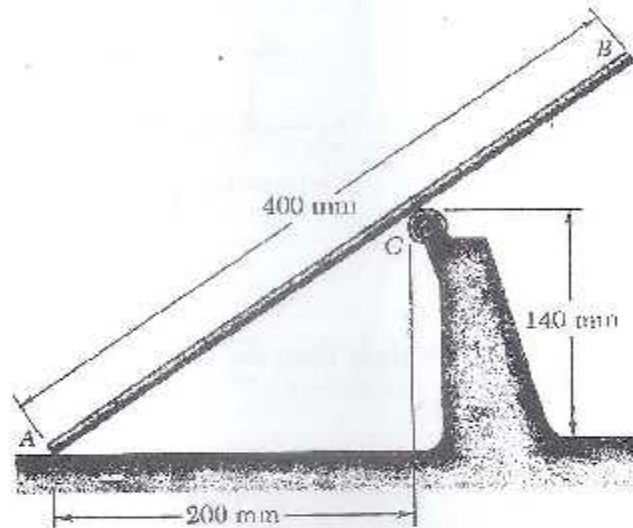


Fig. 7

SECTION-B

- 4(a) (i) Define the following terms: Poisson's ratio, Ductility, Toughness, Brittleness. [2]
 (ii) A vertical rod of 'L' m long fixed at upper end and carries an axial tensile load 'P' force. The rod tapers uniformly from diameter of 'D' at the top and 'd' at the bottom. Derive the expression for the total extension of the bar. [4]

OR

- (ii)' A bar of 30 mm diameter is subjected to a pull of 60 kN. The measured extension on gauge length of 200 mm is 0.09 mm and change in diameter is 0.0039 mm. Calculate the Poisson's ratio, modulus of elasticity (E), modulus of rigidity (C) and bulk modulus (K). [4]
 4(b) At a point in a material under stress, the intensity of the resultant stress on a certain plane is 50 MN/m^2 (tensile) inclined at 30° to the normal of that plane. The [6]

Contd.....3.

stress on a plane at right angles to this has a normal compressive component of intensity of 30 MN/m^2 . Find,

- The principal plane and stresses,
- The plane of maximum shear and its intensity.

- 5(a) Draw the shear force and bending moment diagram for the following beam shown in Fig. 8. Also find the maximum bending moment. [6]

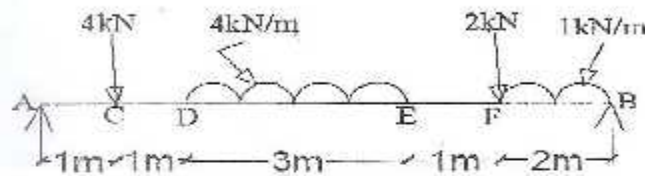


Fig. 8

OR

- 5'(a) Draw the shear force and bending moment diagram for the following beam shown in Fig. 9. [6]

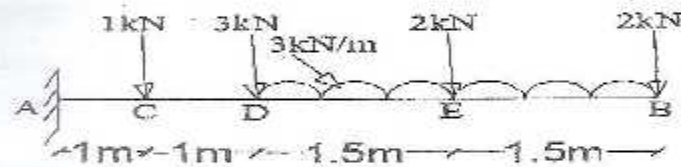


Fig. 9

- 5(b) A cast iron water main 12 meter long of 550 mm outside diameter and 25 mm wall thickness runs full of water and is supported at its ends. Calculate the maximum stress in the metal if density of cast iron is 72 kN/m^3 and that of water is 10 kN/m^3 . [6]

2016-17
B.TECH. (AUTUMN SEMESTER) Examination
APPLIED CHEMISTRY
(AC-111)

Maximum Marks: 60

Duration: Two Hours

Answer all the questions.

Assume suitable data if missing.

- 1(a) Give the requirements of a good disinfectant. Describe the disinfection of water using bleaching powder. Mention its demerits. [04]
- (b) A water sample on analyses has the following analytical data in mg/L: [06]
 $\text{Mg}(\text{HCO}_3)_2 = 14.6$, $\text{Ca}(\text{HCO}_3)_2 = 16.2$, $\text{MgCl}_2 = 9.5$, $\text{CaSO}_4 = 13.6$ and $\text{NaCl} = 11.0$. Calculate temporary and permanent hardness of the water sample in mg/L. Calculate the amount of lime and soda required in kg for softening of 10^6 litre of water. [At. wts.; Mg = 24, Ca = 40, Cl = 35.5, C = 12, H = 1, O = 16, Na = 23, S = 32]
- (c) Describe the softening of water by zeolite process. Give its advantages and disadvantages. [5]

OR

- 1'(a) Write notes on the followings: [4×3]
(i) Priming and foaming
(ii) Requirements of water for municipal and industrial uses
(iii) Sludge and scale formation in boiler
- (b) Describe the role of alum and sodium aluminate in coagulation of impurities in water. [3]
- 2(a) What are fuels? How are they classified? Give examples in each category. [3]
- (b) Differentiate between any TWO of the followings: [2×2]
(i) Net and Gross Calorific value
(ii) Proximate and ultimate analyses
(iii) LPG and CNG

Contd...2-

- (c) Explain the selection of lubricant for [3]
 (i) Cutting tools
 (ii) Internal combustion engine
- (d) Calculate amount of oxygen and air required for combustion of 1 kg coal having the [5]
composition: C = 86%, H = 8%, O = 2% and ash = 4%.

OR

- (d') With the help of suitable diagram discuss the mechanism of thick film lubrication. [5]
- 3(a) Discuss the mechanism of corrosion of iron in neutral aqueous solution in presence [5]
of dissolved oxygen.
- (b) What are characteristics of good paint? Discuss the role of pigments in paint. [4]
- (c) Describe the following factors affecting the rate of corrosion: [6]
 (i) Purity of metal
 (ii) Influence of pH
 (iii) Relative areas of anodic and cathodic parts
 (iv) Presence of impurities in atmosphere

OR

- (c') Write a note on galvanizing. [6]
- 4(a) With suitable examples give the classification of polymers on the basis of [4]
 (i) structure and (ii) synthesis
- (b) Write short notes on any **THREE** of the followings: [3×3]
 (i) Limitations of natural rubber
 (ii) Vulcanisation of rubber
 (iii) Preparation, properties and uses of Bakelite
 (iv) Free radical mechanism of polymerisation
- (c) Write preparation and properties of Buna-S. [2]
-

2016-2017

B. TECH/B.ARCH. AUTUM (I SEMESTER) EXAMINATION
(ELECTRICAL/MECHANICAL/CIVIL/ELECTRONICS/COMPUTER/
CHEMICAL/PETRO-CHEMICAL ENGINEERING)

MATHEMATICS – I

(AM – 111)

CREDITS: 04

Max Marks: 60

Duration: Two Hours

Note : Answer all questions.

1. (a) Show that system of equations $-2x + y + z = a$, $x - 2y + z = b$, $x + y - 2z = c$ has no solution unless $a + b + c = 0$. In which case there are infinity many solution? [8+7]
Find the solution when $a = 1$, $b = 1$, $c = -2$.

(b) Given matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 0 & -2 & 6 \\ 0 & 0 & -3 \end{bmatrix}$

Find eigen values and eigen vectors of the matrix A. Also find the eigen values of $3A^3 + 5A^2 + 6A + I$.

OR

(b') Using Cayley-Hamilton theorem find the adjoint of the matrix $\begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$

2. (a) Find the asymptotes of the curve [7.5+7.5]
 $x^4 - 13x^2y^2 + 36y^4 + 5x^2y - 5xy^2 - 30y^3 + xy + 7y^2 - 1 = 0$ and show that they cut the curve at eight points which lie in a circle.

OR

(a') Trace the curve $y = \frac{x^2}{1-x^2}$ giving its salient features

(b) If $y = \sin(m \sin^{-1} x)$, show that $(1-x^2)y_{n+2} - (2n+1)xy_{n+1} - (n^2 - m^2)y_n = 0$ also find $y_n(0)$.

3. (a) A quadrant of a circle of radius a revolves about its chord. Show that surface area [7.5+7.5]
of spindle generated is given by $2\pi a^2 \sqrt{2} \left(1 - \frac{\pi}{4}\right)$.
- (b) Find the length of one loop of the curve $9y^2 = (x-4)(x-7)^2$.

OR

(b') Show that the volume of the solid generated by the revolution of the curve $(a-x)y^2 = a^2x$ about its asymptote is $\frac{1}{2}\pi^2 a^3$.

4. (a) Solve :

[7.5+7.5]

(i) $(D^2 - 1)y = \sin hx \cosh x \cos x$

(ii) $x^2 \frac{d^2y}{dx^2} + 4x \frac{dy}{dx} + 2y = e^x$

(b) Solve the simultaneous equations

$$\frac{dx}{dt} + \frac{dy}{dt} - 2y = 2 \cos t - 7 \sin t$$

$$\frac{dx}{dt} - \frac{dy}{dt} + 2x = 4 \cos t - 3 \sin t$$

OR

(b') The differential equation for an electrical circuit is given by

$$L \frac{d^2i}{dt^2} + \frac{i}{c} = 0, \text{ where } L \text{ \& } C \text{ are constants and have their usual meanings.}$$

Find the current i as a function of t , given that I is maximum current and $i = 0$ when $t = 0$.

2016-17

B. TECH. (AUTUMN SEMESTER) EXAMINATION

(Civil/Chemical/Computer/Electrical/Electronics/Mechanical/Petro-Chemical/Arch.Engg.)

APPLIED PHYSICS

AP111

Maximum Marks: 60

Credits: 04

Duration: Two Hours

- Answer ALL the questions. Symbols used have their usual meanings.
- Some useful physical constants are given at the end of the questions paper.

- 1(a) With the help of a suitable diagram describe the process of formation of energy bands in Si. Show that the electric current contribution of a hole is in fact due to the motion of uncompensated electron in valance band. [06]
- (b) What is Hall effect? Give its two applications. A current of 1 mA is passed through a germanium sample by applying a potential difference of 400 mV across its length. This sample is placed normal to 0.5 Tesla magnetic field. Calculate Hall voltage, if concentration of majority carriers = $5.2 \times 10^{19} \text{ m}^{-3}$, length of the sample is 2 cm, width and the thickness of the sample are 1 cm each. [04]
- 2(a) Sketch the path of light inside the core of a reflected and refracted fiber. Obtain an expression for numerical aperture (NA) of an optical fiber. Calculate NA and acceptance angle for an optical fiber whose core and cladding refractive indices are 1.50 and 1.48 respectively. [05]
- (b) How many types of optical fibres are possible on the basis of material used for their construction? Discuss the processes of signal distortion and transmission loss in optical fibers. [05]
- 3(a) Write various characteristics of laser light. Mention some applications of laser. [03]
- (b) Explain the working of a He-Ne laser. How He-Ne laser is different from ruby laser? [07]
- Or
- 3'(a) For laser action to occur, the medium used must have at least three levels. What must be the nature of each of these levels? Why is three the minimum number? [04]
- (b) With a suitable, energy band diagram, explain the laser action in a semiconductor laser. In what way a *pn*-junction diode used in semiconductor laser is different from an ordinary *pn*-junction diode? [06]
- 4(a) Explain Compton effect and deduce an expression for the change in wavelength of a photon scattered through an angle Φ by a particle of rest mass m_0 . [07]

Continued2

- 2 -

- (b) Define phase and group velocities. Show that the group velocity of a wave is given by: [03]

$$v_g = \frac{dv}{d\left(\frac{1}{\lambda}\right)}$$

- 5(a) What are important features of "well behaved wave functions"? [02]
- (b) Discuss, quantitatively, the problem of a particle trapped in a one dimensional box L wide and obtain the expression for its normalized wave function. Plot the wave function for the two lowest quantum states. [08]

- 6 (a) Derive an expression for the energy distribution of an ideal gas molecules, $n(\epsilon)d\epsilon$ with energies between ϵ and $\epsilon + d\epsilon$ in a sample of a gas that contains N molecules at absolute temperature T. [06]
- (b) Write three statistical distribution functions for classical and quantum mechanical particles. Show that probability of occupancy of a quantum state by two bosons to be in the same state is twice that for two classical particles whereas it is zero for two fermions. [04]

Or

- 6' Define Fermi energy. Obtain an expression for the quantum states of free electron in a metal, $g(\epsilon)d\epsilon$ and hence deduce an expression for the Fermi energy. Show that the average energy of free electron in a metal at 0K is 60% of its Fermi energy. [10]

Some Useful Physical Constants

$$h = 6.63 \times 10^{-34} \text{ J.s,}$$

$$k = 1.38 \times 10^{-23} \text{ J/K}$$

$$m_e = 9.1 \times 10^{-31} \text{ kg,} \quad m_p = 1.67 \times 10^{-27} \text{ kg,} \quad c = 3 \times 10^8 \text{ m/s} \quad n_i(\text{Si}) = 1.5 \times 10^{10} \text{ cm}^{-3}$$

$$n_i(\text{Ge}) = 2.5 \times 10^{13} \text{ cm}^{-3}$$

2016-17
B.ARCH. (III SEMESTER) EXAMINATION
AR 103, Architectural Drawing -I
Credits: 4

Maximum Marks: 40

Duration: 2 Hours

Answer all the questions.

Suitable assume any missing data.

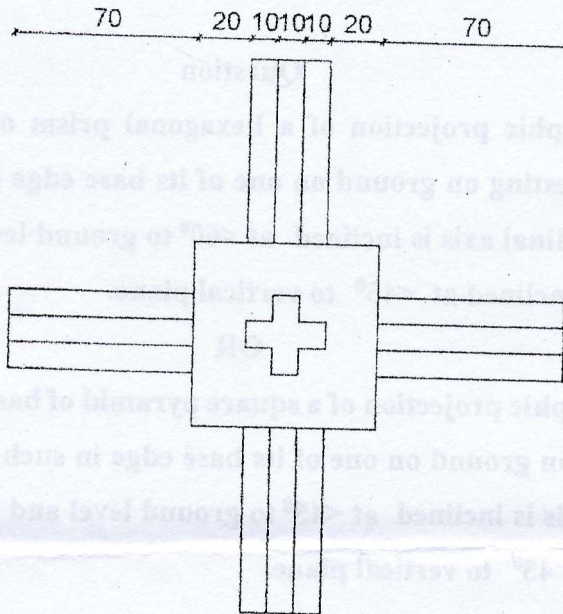
All dimensions are in mm.

Neat and good drafted drawings will be credited more.

- | Q.No. | Question | M.M. |
|-------|--|------|
| 1 | Draw orthographic projection of a hexagonal prism of base side 30mm & height 60mm resting on ground on one of its base edge in such a way that its central longitudinal axis is inclined at $<60^{\circ}$ to ground level and edge touching ground is also inclined at $<45^{\circ}$ to vertical plane. | 15 |
| OR | | |
| 1' | Draw orthographic projection of a square pyramid of base side 30mm & height 60mm resting on ground on one of its base edge in such a way that its central longitudinal axis is inclined at $<45^{\circ}$ to ground level and edge touching ground is inclined at $<45^{\circ}$ to vertical plane. | 15 |
| 2 | A cylinder of base diameter 30mm and height 70 mm is resting on ground on its base. It is being cut by a plane which is inclined at $<60^{\circ}$ to ground and perpendicular to vertical plane in such a way that its passing through central longitudinal axis at height 30mm. Draw development of surface of bottom part of truncated cylinder. | 10 |
| 3 | Draw isometric view of the object shown in Figure -1 | 15 |

Contd....-2

- 2 -



PLAN AND ALL ELEVATION

FIGURE - 01

2016-17
B.ARCH. (AUTUMN SEMESTER) EXAMINATION
B. ARCH I- YEAR
PRINCIPLES & PHILOSOPHY OF ARCHITECTURE
AR-112

Maximum Marks: 60

Credits: 04

Duration: Two Hours

Answer all the questions.

Draw sketches to support your answer.

Q.No.	Question	M.M.
1	Explain with neat sketches how mathematics play an important role in architectural compositions?	[10]
OR		
1'	What are the basic responsibilities of an Architect, explain the need of an Architect in present day situation?	[10]
2	What are the basic Principles of Architectural Design, explain the various types of hierarchy applied in architectural compositions?	[10]
OR		
2'	What are the indispensable elements of architectural design, explain how different planes are employed in any architectural symphony?	
3	Explain how architecture serves as discipline and profession?	[10]
4	How do geography be germane in architecture, explain with sketches how architecture of different geographic region changes according to their climatic conditions?	[15]
5	What is the basic philosophy of Lauri Baker, explain how he has incorporated locally available materials & traditional techniques in his designs?	[15]

2016-17
B.TECH. (AUTUMN SEMESTER) EXAMINATION
ELECTRONICS/COMPUTERS/ELECTRICAL/MECHANICAL/CIVIL/CHEMICAL/
PETROCHEMICAL
ENVIRONMENTAL STUDIES
CE111

Maximum Marks: 60

Credits: 04

Duration: Two Hours

Answer all the questions.

Assume suitable data if missing.

Notations used have their usual meaning.

Q.No.	Question	M.M.
1.	Differentiate between food chain and food web. Describe different types of food chains.	[10]
OR		
1'.	Define ecological pyramid. Describe different types of ecological pyramids.	[10]
2.	Define Pollutants. Write about Water pollution and Land pollution in terms of Causes, Effects and Control measures.	[10]
3.	Why it is preferable to harvest rainwater? Give name and function of different components of the system used to harvest rainwater?	[10]
4(a).	Discuss different forms of population growth curves, give their shapes too.	[05]
4(b).	Write an short notes on any one of the followings: a) Water conservation. b) Watershed management and its classification. c) Population explosion.	[05]
5(a).	Explain causes of man induced landslides.	[05]
OR		
5'(a)	Discuss at least two renewable energy resources.	[05]
5(b).	Explain ozone layer depletion with diagram and reactions.	[05]
6(a).	Explain at least 6 vital signs of climate change faced by earth	[05]
6(b)	State salient features of any one of the following acts in India. a) Wildlife Protection Act b) Air (Prevention and Control of Pollution) Act c) Water(Prevention and Control of Pollution) Act	[05]

2016-17
B.TECH. (AUTUMN SEMESTER) EXAMINATION
ALL BRANCHES
Basic Electrical and Electronics Engineering
EE111

Maximum Marks: 60

Credits: 04

Duration: Two Hours

Answer all the questions.

Assume suitable data if missing.

Notations used have their usual meaning.

Attempt PART A & PART B on separate answer book

PART A (ELECTRICAL ENGINEERING)

Q.No.

Questions

M.M.

[3×5]

1 Attempt any THREE of the following questions

- a) Find the value of current I as shown in figure 1 by using superposition theorem.

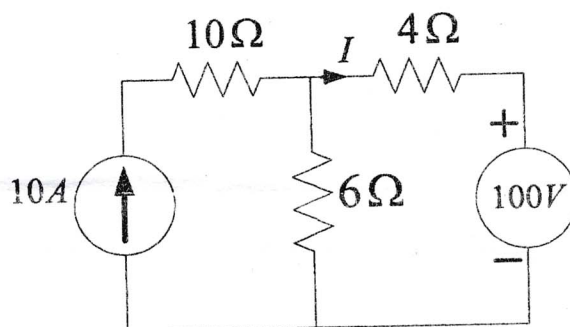


FIGURE 1

- b) Find the Thevenin equivalent circuit as shown in figure 2 across the terminal A-B.

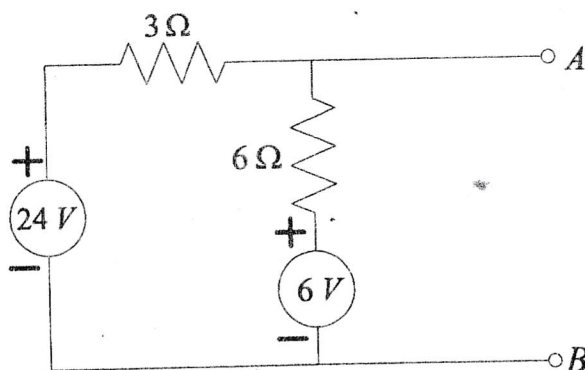


FIGURE 2

Contd...2.

- c) Three impedances Z_1, Z_2 and Z_3 are delta connected to a balanced three phase 400 V, 50 Hz supply of phase sequence ABC. $Z_1 = 20\angle 0^\circ \Omega$ connected between lines A and B, $Z_2 = 20\angle 0^\circ \Omega$ connected between lines B and C, $Z_3 = 20\angle 0^\circ \Omega$ connected between lines C and A. Calculate the phase and line currents and the active or real power consumed.
- d) Describe the principle of operation of single phase transformer. Derive the expression of induced emf in a transformer.
- e) Define the terms Residual flux density, Active power, Reactive power, Power factor and Core loss in a transformer.

2 Attempt any **TWO** of the following questions [2×7.5]

- a) Why can an induction motor not run at synchronous speed? The voltage applied to the stator of a three phase, 4 pole induction motor has a frequency of 50 Hz. The frequency of the emf induced in the rotor is 2 Hz. Calculate the slip and speed at which motor is running.
- b) With the help of circuit diagram describe the working of a capacitor-start capacitor-run single phase induction motor.
- c) With the help of suitable diagram explain the operation of a permanent magnet moving coil instrument. Why the scale of moving iron instruments is non uniform?
- d) Draw the layout of thermal power plant and briefly describe each component.

PART B (ELECTRONICS ENGINEERING)

- 3(a) Sketch the I-V characteristics of a *pn* junction diode in forward and reverse bias, and mark the knee (threshold) voltage. Using the diode equation, determine the diode current at $T = 300$ K for a silicon diode with $I_s = 20$ nA and applied forward bias of 0.6V (Assume $n = 1$). [07]

OR

- 3(a') Give the piecewise linear equivalent circuit model of a diode and its mathematical expression of diode current in term of diode voltage. Determine I and V_o for the circuit shown in Fig. 1. Use the piecewise linear equivalent circuit model of diode with $r_D = 50\Omega$. [07]

Contd...3.

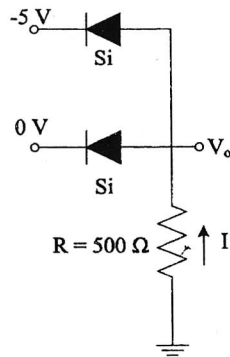


Fig. 1

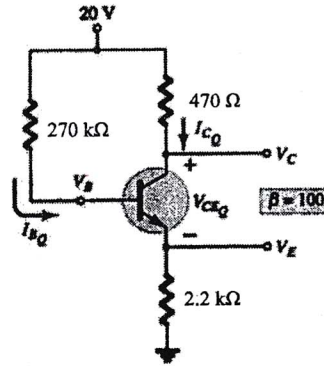


Fig. 2

3(b) For the circuit shown in Fig. 2, determine, I_B , I_E , I_C and V_{CE} (Neglect I_{CBO} current). [8]

4(a) With proper labelling, draw the physical structure (construction) of the n-channel enhancement type MOSFET and its circuit symbol. Also, sketch its I_D - V_{GS} and I_D - V_{DS} characteristics. [8]

4(b) Give the operational amplifier based integrator circuit and derive its output voltage expression. [7]

OR

4(b') Derive the output voltage expression in term of all the three input voltages for the circuit given in Fig. 3 and calculate the output voltage for $R_1 = 33 \text{ k}\Omega$, $R_2 = 22 \text{ k}\Omega$, $R_3 = 12 \text{ k}\Omega$, $R_f = 68 \text{ k}\Omega$, $V_1 = 0.2\text{V}$, $V_2 = -0.5\text{V}$ and $V_3 = 0.8\text{V}$. Assume ideal operational amplifier. [7]

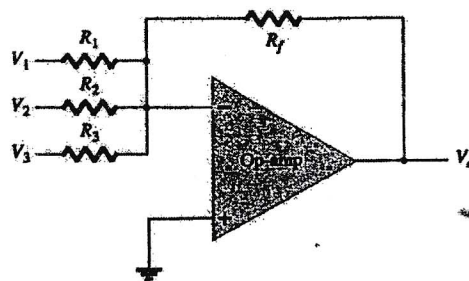


Fig. 3

2016 – 2017
B.ARCH/B.TECH AUTUMN (I SEMESTER) EXAMINATION
(ELECT/MECH./CIVIL/CHEM.ELECTRONICS/COMPUTER/
PETRO-CHEMICAL ENGINEERING)
ENGLISH
(EN-101)
Credits: 04

Maximum Marks: 60

Duration: Two Hours

Answer all questions.

UNIT – I

1. a. Read the passage and answer the questions that follows: (5 x 2 = 10)
- Unlike the scientist, the engineer is not free to select the problem which interests him, he must solve the problems as they arise, and his solutions must satisfy conflicting requirements. Efficiency costs money, safety adds complexity, performance increases weight. The engineering solution is the optimum solution, the most desirable end result taking into account many factors. It may be the cheapest for a given performance, the most reliable for a given weight, the simplest for a given safety, or the most efficient for a given cost. Engineering is optimizing.
- To the engineer, efficiency means output divided by input. His job is to secure a maximum output for a given input or to secure a given output with a minimum input. The ratio may be expressed in terms of energy, materials, money, time and men
- i. What is engineering? (2)
 - ii. What factors may inhibit efficiency? (2)
 - iii. What factor must an engineer bear in mind for efficient results? (2)
 - iv. List any two indices affecting desired optimum results. (2)
 - v. How is an engineer different from a scientist? (2)
- b. Write a summary of the passage given above. (10)

UNIT – II

- Q2. Elucidate the chief tenets of 'Animalism' as visioned by Old Major?
 Or
 Write a character sketch of Napoleon (5)
- Q3. What kind of people were the Elois? Elaborate (5)
 Or
 Write a brief note on the year 802701 AD?

Contd.....2.

[2]

UNIT – III

Q4. Write the process of applying for a Debit Card in your bank (10)

Or

Write a report on the Tech Fest held in your college

Or

Write a report, on the celebration of Independence Day in your Hall

UNIT – IV

Q5. Read the following passage and write a précis of the same (10)

Quasi-stars are a new phenomenon in the universe, and everybody is wondering what they are. Their light seems too bright to come from any known physical process. They broadcast powerful radio waves which may vary in strength. Some of them lie near the limits of observable space and time, and promise to provide a crucial test of rival theories of the universe.

Quasi-stars were discovered in 1963 as a result of an effort to overcome the shortcomings of radio telescopes. Compared to optical telescopes, these are blunt instruments. They can spot (locate) a radio star (a source of radio waves in the sky) but can give only the most general clues as to its distance and nature. Progress depends on identifying radio stars with some kind of object emitting visible light but radio astronomers can give their optical colleagues only rather imprecise directions as to where to look.

UNIT – V

Q6. Write an essay on any one of the following topics in about 300 words (10)

i. Drones: A boon or bane

ii. Internet: A mixed bag of goods

2016-17
B.TECH. (AUTUMN SEMESTER) EXAMINATION
 Chemical/Civil/Computers/Electrical/Electronics/Mechanical/Petro-Chemical
THERMAL SCIENCES
ME 101

Maximum Marks: 60

Credits: 04

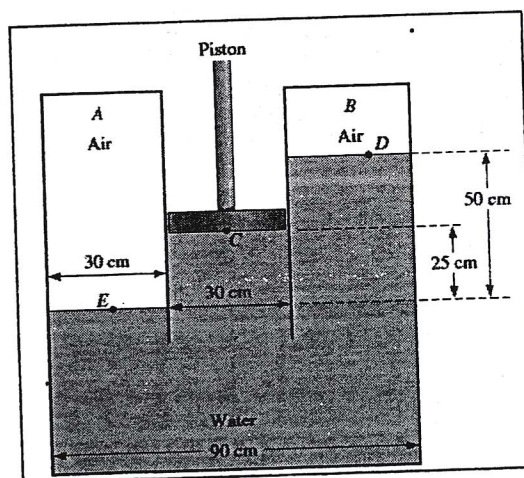
Duration: Two Hours

Answer all the questions.

Assume suitable data if missing.

Use of Steam Tables is allowed

- 1(a) Classify the following underlined entities as system, control volume or neither: [2]
- Contents of a closed flask
 - Air inside a tyre being inflated
 - Sand in a sand clock
 - Air conditioner
- 1(b) What is the Thermodynamic Concept of Energy? Explain in terms of point and path functions. [3]
- 1(c) Fill in the blanks: [3]
- A four-stroke engine has _____ power stroke(s) for every _____ revolutions of crankshaft.
 - In a petrol engine, the mixture has the lowest pressure at the beginning of _____ stroke.
 - The electric company charges its customers per kilowatt-hour. In SI units it is _____
- 1(d) Two chambers with the same fluid at their base are separated by a piston whose weight is 25 N, as shown in the figure. Calculate the gage pressures in chambers A and B. [7]



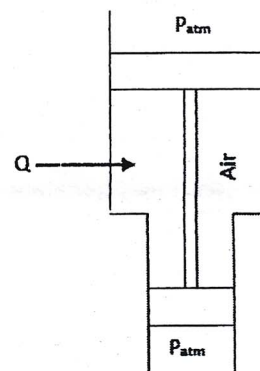
Contd. on 2.

2(a) Determine whether the heat and the work interactions for the following cases are positive, negative, zero or indeterminate. The systems to be considered are underlined: [3]

- i) The air in a tyre and connected pump. The pump plunger is pushed down, forcing air into the tyre. Assume pump, tyre and connecting tube to be non-conducting.
- ii) Steam in a closed vessel at a temperature of 150°C is left standing in the atmosphere at a temperature of 25°C .
- iii) Gas in an insulated cylinder expands as the piston is slowly moved outwards.
- iv) The water and water vapor in a closed rigid container. The container is set on a stove and the temperature and pressure of the contents increase.
- v) The system in part (iv) bursts its container and explodes into a cold atmosphere.
- vi) 1 kg of air flows rapidly from the atmosphere into a previously evacuated bottle.

2(b) A water turbine at the bottom of a dam gives energy out as power on a shaft. Which term(s) in the energy equation are changing? [2]

2(c) Consider the frictionless piston-cylinder arrangement shown in the figure, in which two pistons are connected by a thin rod of negligible mass and volume. A certain amount of air is enclosed in the space between the pistons such that the piston assembly is initially in equilibrium. The cross-sectional area of the upper piston is 10 cm^2 greater than the lower one. The combined mass of the pistons is 5 kg . A very slow heating process now takes place as a result of which the piston assembly moves upward by 25 cm .



- Determine (a) the initial pressure of the air,
 (b) the work interaction for the piston assembly,
 (c) the work interaction for the atmosphere and
 (d) the work interaction for air. (Take $P_{\text{atm}} = 10^5\text{ Pascal}$)

OR

2'(a) Apply SFEE to the various components of a steam power plant. Also, find an expression for the efficiency of the power plant. [10]

Contd... 3.

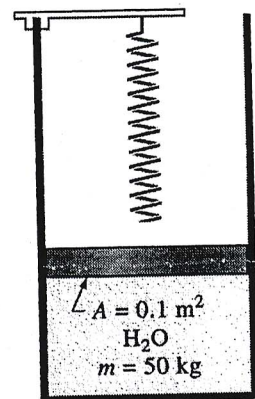
2'(b) At the beginning of the compression stroke of a two-cylinder internal combustion engine the air is at a pressure of 101.325 kPa. Compression reduces the volume to $1/5^{\text{th}}$ of its original volume, and the law of compression is given by $pv^{1.2} = \text{constant}$. If the bore and stroke of each cylinder is 0.15 m and 0.25 m, respectively, determine the power absorbed in kW by compression strokes when the engine speed is such that each cylinder undergoes 500 compression strokes per minute. [5]

3(a) Fill in the blanks: [3]
 i) The state beyond which there is no distinct vaporization process is called the _____.
 ii) With the increase in pressure, the boiling point of water _____.
 iii) The throttling process on a $h-s$ diagram will be a _____ line.

3(b) Make properly labelled control volumes and analyse. [12]
 i) Steam enters a convergent-divergent nozzle with a velocity of, a pressure 8 bar and with superheat of 77.9°C . The steam leaves the exit section of the nozzle at a pressure of 1.6 bar with a dryness fraction of 0.96. The cross-sectional area of the exit nozzle is 12 cm^2 . The flow is adiabatic. Determine the steam velocity at the exit section and the steam mass flow rate.
 ii) The exhaust steam from the nozzle flows into a condenser and leaves it as water with negligible velocity at a temperature of 95°C . Determine the mass flow rate of cooling water required if it enters the condenser at a temperature of 10°C and leaves at a temperature of 25°C .

OR

3'(a) A piston-cylinder device contains 50 kg of water at 250 kPa and 25°C . The cross-sectional area of the piston is 0.1 m^2 . Heat is now transferred to the water, causing part of it to evaporate and expand. When the volume reaches 0.2 m^3 , the piston reaches a linear spring whose spring constant is 100 kN/m. More heat is transferred to the water until the piston rises 20 cm more. Show the process on a P-v diagram and determine
 (i) The final pressure and temperature
 (ii) The work done during this process.



Contd. →

- 3'(b) On the P-v diagram, sketch the constant temperature process through the state $P = 300 \text{ kPa}$, $v = 0.525 \text{ m}^3/\text{kg}$ as pressure changes from $P_1 = 200 \text{ kPa}$ to $P_2 = 400 \text{ kPa}$ with respect to the saturated liquid and saturated vapour lines. Use arrows to indicate the direction of the process, and label the initial and final states. Place the value of the temperature on the process curve on the P-v diagram. [6]
- 4(a) Fill in the blanks: [3]
- Clausius inequality is mathematically stated as _____
 - It is impossible for a system working in a cycle to have as its sole effect the transfer of heat from a system at a constant _____ temperature to a system at a constant _____ temperature.
 - PMM2 is _____
- 4(b) Two Carnot engines have the same efficiency but have different operating temperatures. One engine runs in reverse as a heat pump, and the other runs in reverse as a refrigerator. The coefficient of performance of the heat pump is 1.5 times the coefficient of performance of the refrigerator. Find COP of the refrigerator. [6]
- 4(c) Steam enters an adiabatic turbine steadily at 3 MPa and 400°C and leaves at 50 kPa and 100°C. Show the actual and isentropic expansion processes on a T-s diagram and determine the isentropic efficiency of the turbine. [6]
-

2016-16
B. TECH. (AUTUMN SEMESTER) EXAMINATION
ALL BRANCHES
APPLIED MECHANICS
ME-111

Maximum Marks: 60

Credits: 04

Duration: Two Hours

Answer all the questions.

Assume suitable data if missing.

Notations used have their usual meaning.

Programmable calculators (with extra memory storage) are not permitted.

Part A & Part B need to be solved on separate answer books.

Q.No.

Question

Marks

PART A

- 1(a) Knowing that the tension is 425 N in cable AB and 510 N in cable AC , determine the magnitude and direction of the resultant of the forces exerted at A by the two cables. (Ref. Fig. 1). [06]

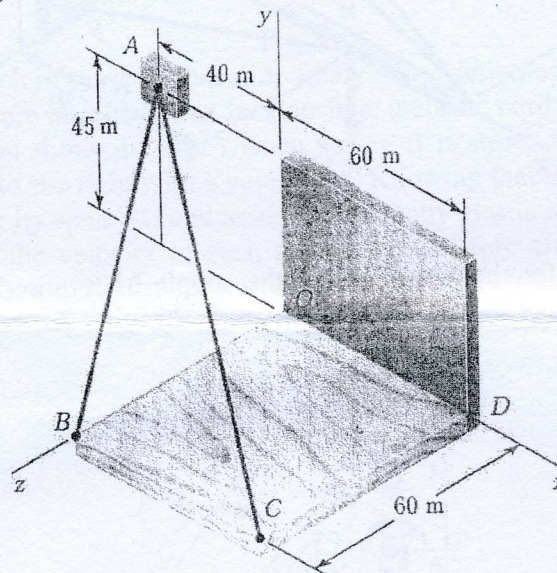


Fig. 1

- 1(b) Block A supports a pipe column and rests as shown in Fig. 2 on wedge B. The coefficient of static friction at all surfaces of contact is 0.25. If $P = 0$, determine (a) the angle θ for which sliding is impending, (b) the corresponding force exerted on the block by the vertical wall.

[06]

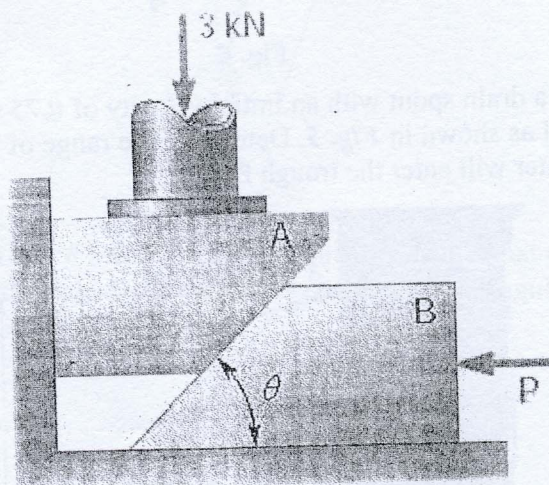


Fig. 2

contd...2

OR

- 1'(a) A 1.2 m boom is held by a ball-and-socket joint at C and by two cables BF and DAE; cable DAE passes around a frictionless pulley at A. For the loading shown in Fig. 3, determine the tension in each cable and the reaction at C. [06]

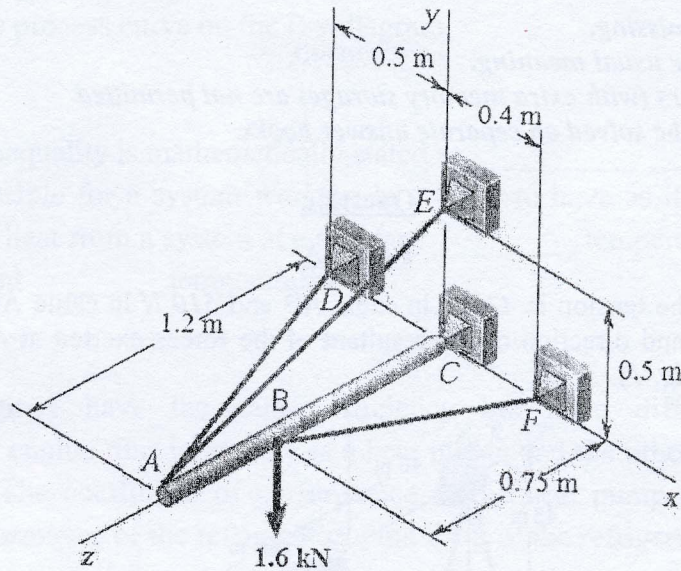


Fig. 3

- 1'(b) Derive an expression for the magnitude of the couple M required to maintain the equilibrium of the linkage shown in Fig. 4. [06]

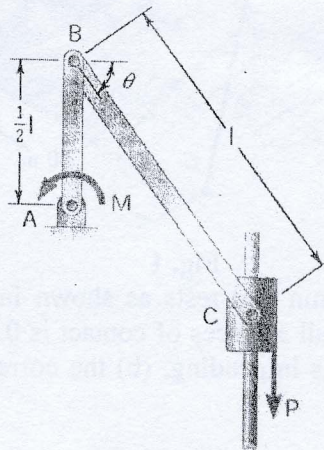


Fig. 4

- 2(a) Water flows from a drain spout with an initial velocity of 0.75 m/s at an angle of 15° with the horizontal as shown in Fig. 5. Determine the range of values of the distance d for which the water will enter the trough BC. [06]

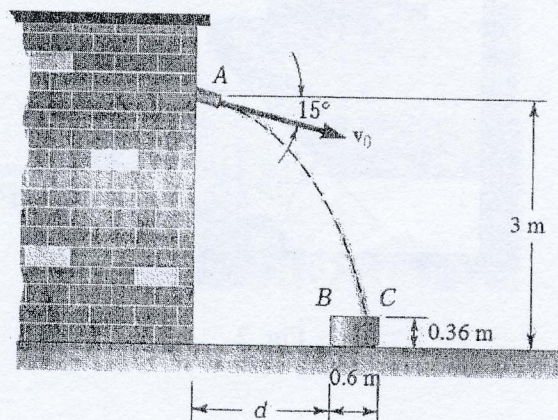


Fig. 5

- 2(b) Rod OA rotates about O in a horizontal plane as shown in Fig. 6. The motion of the 300-gm collar B is defined by the relations $r = 300 + 100 \cos(0.5 \pi t)$ and $\theta = \pi(t^2 - 3t)$, where r is expressed in millimeters, t in seconds, and θ in radians. Determine the radial and transverse components of the force exerted on the collar when (a) $t = 0$, (b) $t = 0.5$ s. [06]

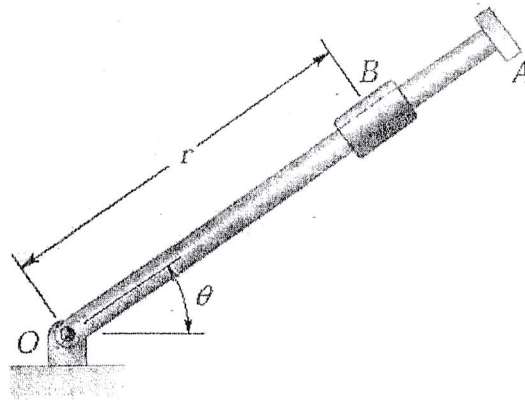


Fig. 6

- 3(a) Three spheres, each of mass m , can slide freely on a frictionless, horizontal surface. Spheres A and B are attached to an inextensible, inelastic cord of length l and are at rest in the position shown in Fig. 7 when sphere B is struck squarely by sphere C which is moving to the right with a velocity v_0 . Knowing that the cord is slack when sphere B is struck by sphere C and assuming perfectly elastic impact between B and C, determine (a) the velocity of each sphere immediately after the cord becomes taut, (b) the fraction of the initial kinetic energy of the system which is dissipated when the cord becomes taut. [06]

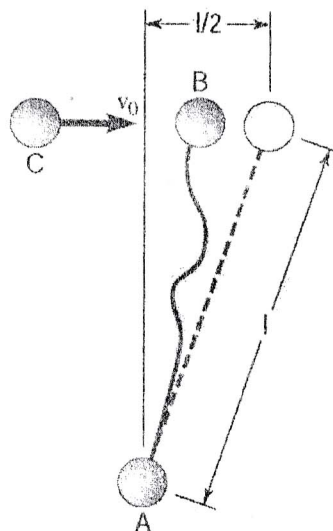


Fig. 7

- 3(b) The plate as shown in Fig 8 moves in the xy plane. Knowing that $(v_A)_x = 120$ mm/s, $(v_B)_y = 300$ mm/s, and $(v_C)_y = -60$ mm/s, determine (a) the angular velocity of the plate, (b) the velocity of point A. [06]

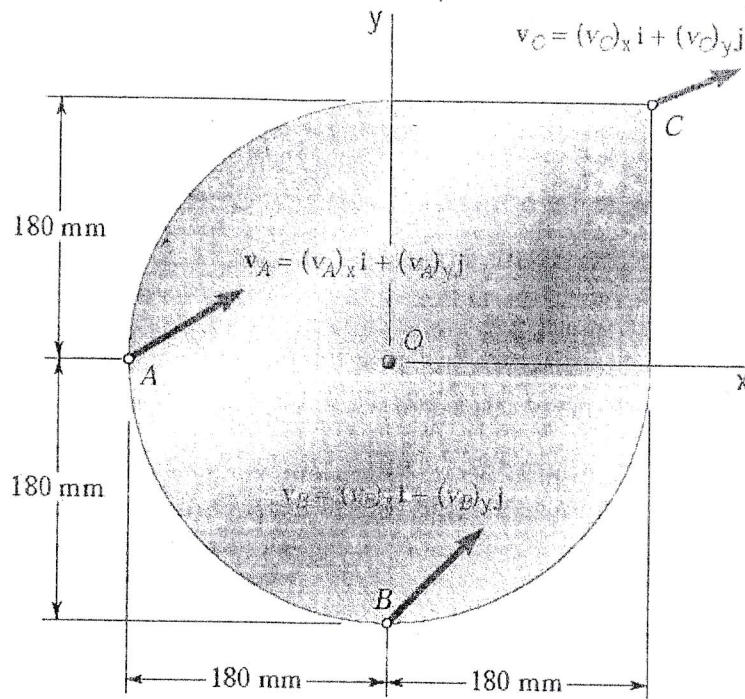


Fig. 8

PART B

- 4 At a point in material under stress, the intensity of the resultant stress on a certain plain (calling it as plane A) is 60 MPa (tensile) inclined 30 degree to normal of that plane. The stress on a plane at right angles (calling it as plane B) to this has a normal tensile component of intensity 40 MPa. Determine (i) the resultant stress on plane B, (ii) the principal planes and stresses, (iii) the plane of maximum shear and its intensity. [12]

OR

- 4' A cast iron water pipe has 500 mm bore and 20 mm metal thickness, and is simply supported at two points 10 m apart. Find the maximum stress in the metal when it is running full. Take unit weight of cast iron as 72 kN/m³ and that of water 10 kN/m³. [12]
- 5 Find shear force and bending force equations along the span pinned at both ends as shown in Fig. 9. Draw corresponding shear force and bending moment diagrams. [12]

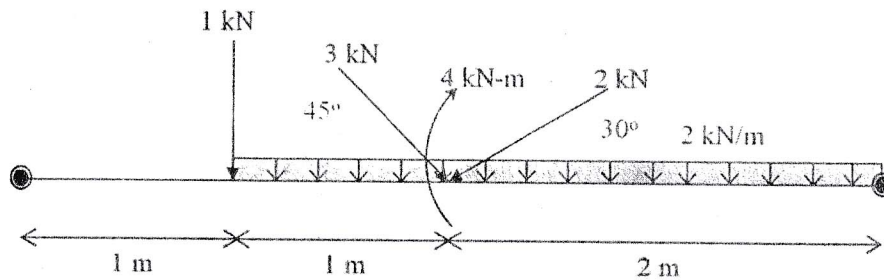


Fig. 9