Maximum Marks: 60

Duration: Three Hours

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

Q.No. | Question |
--- | --- |
1(a) | Differentiate between gravimetric and volumetric methods of chemical analysis. Give the principle and steps involved in gravimetric method of analysis. [05] |
1(b) | Answer any THREE of the following: 
(i) Explain the features of sorption chromatography. [05] 
(ii) Write Beer and Lambert's law. Explain why the percent transmittance of a solution decreases with increasing concentration and on increasing the path length? 
(iii) Explain redox titration with the help of suitable example. 
(iv) List the basic requirements of a titrimetric method. |
2(a) | Explain the determination of permanent and temporary hardness by versanate method. Give the chemical reactions involved in it. [05] 
OR |
2(a)' | Discuss the ion exchange method to obtain demineralised water. How the ion exchangers are regenerated. Give reactions involved in demineralization of water and during regeneration of resins. [05] |
2(b) | Calculate the amount of lime and soda needed to treat 1,00,000 Litres of water containing the following impurities: 
CaCl₂ = 44.4 mg/L; CaSO₄ = 34 mg/L; MgSO₄ = 30 mg/L; KCl = 14.2 mg/L; SiO₂ = 16 mg/L; Ca(HCO₃)₂ = 32.4 mg/L; Mg(HCO₃)₂ = 17.1 mg/L; Na₂SO₄ = 14.2 mg/L
(Atomic Weights; H =1; C = 12; Ca = 40; Mg = 24; Na = 23; K = 39; Cl =35.5; O = 16; Si = 28; S = 32) [05] |

Contd....2.
3(a) Distinguish between proximate and ultimate methods of coal analysis. [04]

3(b) Name the various fractions obtained during fractional distillation of petroleum. Give their temperature ranges also.

OR

3(b') Define calorific value of fuel. The calorific values of gasoline and CNG are 116,000 BTU/galon and 21,000 BTU/galon, respectively. Give the reason why CNG is regarded as better fuel?

3(c) Calculate the mass and volume of air needed to burn 14.2 Kg LPG (butane) completely.

4(a) Explain the mechanism of hydrodynamic and boundary film lubrication. [04]

4(b) Answer any THREE of the following:
(i) The conditions under which grease is used as lubricant.
(ii) Significance of saponification value and aniline point.
(iii) Define viscosity and viscosity index. Write the formula for the calculation of viscosity index.
(iv) What are solid lubricants? Give the conditions where solid lubricants are preferred.

5(a) Define electrode potential. How, the electrode potential of a metal is measured? Explain the mechanism of electrochemical corrosion in the presence of dissolved oxygen in neutral water.

5(b) Name the various methods used to control corrosion and discuss any one of them.

6(a) Differentiate between thermoplastics and thermosetting polymers.

6(b) Discuss the mechanism of free radical addition polymerization of vinyl chloride.

6(c) Write the structural formula of monomer(s) for the following polymers (ANY THREE)
(i) Bakelite
(ii) Nylon-66
(iii) Polyester
(iv) Natural rubber
1. (a) Show that for the surface $x^2y^3z^2 = C$, \[ \frac{\partial^2 z}{\partial x \partial y} = -(x \log ex)^{-1} \] at the point $x = y = z$.

OR

(a') If $u = xf(x/y) + g(y/x)$, prove that
\[ x^2 \frac{\partial^2 u}{\partial x^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} + y^2 \frac{\partial^2 u}{\partial y^2} = 0. \]

(b) If $z = f(x, y)$, where $x = e^u + e^{-v}$ and $y = e^{-u} - e^v$, prove that
\[ \frac{\partial z}{\partial u} \frac{\partial z}{\partial v} = x \frac{\partial z}{\partial x} - y \frac{\partial z}{\partial y}. \]

(c) If $u = x + y - z$, $v = x - y + z$, $w = x^2 + y^2 + z^2 - 2yz$ find \[ \frac{\partial (u, v, w)}{\partial (x, y, z)}. \] Are $u$, $v$, and $w$ are functionally related? If so find the relation among them. [5+4+6]

2. (a) Expand $f(x, y) = e^x \tan^{-1}(y)$ in a power of $(x - 1)$ and $(y - 1)$ up to the second degree terms.

(b) The period of simple pendulum with small oscillations is given by $T = 2\pi\sqrt{\ell/g}$. If $T$ is computed using $\ell = 8$ ft and $g = 32$ ft/sec$^2$, find the approximate error in $T$, if the true values are $\ell = 8.05$ ft and $g = 32.01$ ft/sec$^2$. Find also the percentage error.

(c) Using Lagrange's method of undetermined multipliers, show that the volume of the largest rectangular parallelepiped that can be inscribe in the ellipsoid
\[ \frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1 \] is \[ \frac{8abc}{3\sqrt{3}}. \]

OR

(c') The temperature $T$ at any point $(x, y, z)$ in space is $T = 400xyz^2$. Find the highest temperature on the surface of the Unit sphere $x^2 + y^2 + z^2 = 1$. [5+4+6]
3. (a) Evaluate \( \int \int (x + y)^2 \, dx \, dy \) over the region bounded by the ellipse \( \frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 \). 

OR

(a') Find by double integration the area lying inside the Cardioid \( r = (1 + \cos \theta) \) and outside the parabola \( r(1 + \cos \theta) = 1 \).

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

\[
\int_{a}^{b} \int_{a}^{\frac{b}{a}} \frac{y \, dx \, dy}{(a-x)(ax-y^2)^{\frac{1}{2}}}.
\]

(c) Find by triple integration the volume cut off from the cylinder \( x^2 + y^2 = ax \) by the planes \( z = mx \) and \( z = nx \). \([5+5+5]\)

4. (a) Trace the conic

\[
22x^2 - 12xy + 17y^2 - 112x + 92y + 178 = 0
\]

Give its salient features.

(b) A circle of given radius passing through the focus \( S \) of a given conic intersects it in four points \( A, B, C \) and \( D \). Show that

\[
SA \cdot SB \cdot SC \cdot SA \text{ is constant.}
\]

OR

(b') A point moves so that the sum of its distances from two fixed points \( S, S' \) is constant and equal to \( 2a \). Show that \( P \) lies on the conic

\[
\frac{a(1-e^2)}{r} = 1-e\cos\theta,
\]

referred to \( S \) as pole and \( SS' \) as the initial line, the \( SS' \) being equal to \( 2ae \). \([9+6]\)
2015-16
B.TECH. (WINTER SEMESTER) EXAMINATION
(Civil/Chemical/Computer/Electrical/Electronics/Mechanical/Petro-Chemical)
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) By using Fermi-Dirac distribution function and density of states in conduction band, obtain an expression for electron concentration at equilibrium in a semiconductor and discuss shifting of Fermi level with the doping concentration of either type. [5.5+1]

OR

1(a') Define mobility of an electron in a material. Obtain an expression for total current density in a semiconductor taking into consideration the contribution of electrons and holes. Hence write expression for electrical conductivity. [1+5+0.5]

1(b) A Si sample is doped with 1.5×10^{17} phosphorus atoms/cm^3. What Hall voltage would you expect in a sample 100 μm thick if I_x=1 mA and B_x= 1 kG? [3.5]

2(a) What is the basic principle of optical fiber communication? Obtain an expression for numerical aperture in case of a step index fiber. What is the main cause of signal distortion in step index multimode fibers? [1+3.5+1]

2(b) Discuss attenuation of a signal in optical fiber with the help of decibels(dB)/km vs. λ graph. [2.0]

2(c) Calculate refractive indices of core and cladding materials of an optical fiber if numerical aperture is 0.23 and relative refractive index is 0.012. [2.5]

3(a) Define the terms; induced absorption, stimulated emission and population inversion. Discuss construction and working of ruby laser with the help of suitable diagrams. What is the main drawback of this laser? [1.5+5.0]

3(b) What are the important characteristics of a laser? Discuss applications of laser in industry. [3.5]

OR

3(b') A typical ruby laser emits radiation of 6943 Å because of transition between the energy levels of Cr^{3+} ions. If ruby is 6 cm long 0.8 cm in diameter contains 10^{19} Cr^{3+} ions/cm^3. What is the maximum energy of a pulse radiation emitted by this ruby laser? If pulse lasts for 5×10^{-9} sec, what is average power of the laser during the pulse? [3.5]

4(a) With the help of suitable diagrams discuss the production mechanisms of i) continuous and ii) characteristic x-rays. The accelerating voltage in a typical x-ray tube is 25 kV; determine the frequency of the most energetic x-ray photon emitted in this tube. [2+2+3]

Contd.....2.
4(a') What is Compton effect? Derive an expression for the Compton shift, \((\lambda' - \lambda)\) when a photon is scattered by an electron and briefly explain the presence of original wavelength at every angle of scattering [1+5+1]

4(b) Explain group velocity. Show that the velocity of the wave group associated with a particle is equal to the velocity of the particle. [1+2]

5(a) What is a wave function? Write the characteristics of a well behaved wave function. Set up the time dependent form of Schrödinger equation and hence deduce its steady state (time independent) form. [2+4+2]

5(b) Estimate the probability of finding a particle trapped in a box L wide, between \(x=0.4L\) & \(x=0.6L\) in its ground state, i.e., \(n=1\). [2]

6(a) What is the significance of statistical mechanics? Derive an expression for molecular energy distribution, \(n(\varepsilon)d\varepsilon\) of an ideal gas. Use this distribution to show that average energy of ideal gas molecules is \(3kT/2\). [1+5+2]

**OR**

6(a') Write the expression for the energy distribution, \(n(\varepsilon)d\varepsilon\) of ideal gas molecules and hence deduce their speed distribution. Plot this speed distribution and mark the various speeds on this curve. Use the speed distribution to show that average speed of ideal gas molecules is \((8kT/m)^{1/2}\). [5+3]

6(b) The Fermi energy in silver is 5.51 eV. Find 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? [2]

---

**Some useful physical constants**

Planck's constant, \(h = 6.63 \times 10^{-34}\) J.s; Boltzmann constant, \(k = 1.38 \times 10^{-23}\) J/K; mass of an electron, \(m_e = 9.11 \times 10^{-31}\) kg; speed of light, \(c = 3 \times 10^8\) m/s; charge on electron, \(e = 1.6 \times 10^{-19}\) C

*******************************
Present the drawings and sketches to scale with dimensions and specifications. Assume and write the missing data/situation/dimensions.

1. Sketch and label the following (any two):
   a) Trowel
   b) King Closer
   c) Coping

2. Draw plan, elevation and Isometric view/detail of the following (any two).
   1. Squint Quoin of one brick thick wall in English Bond
   2. Coursed rubble stone masonry
   3. Raking shore for 3 storied building adjoining the construction site.

3. Write short Notes on the following (any three).

   I. Availability, affordability, economic viability, sustainability and ecological implications of natural construction materials like timber, clay and stones.
   II. Enumerate various timber products discussing manufacturing of 3-ply Plywood mentioning any three popular brands.
   III. Ceramic and Vitrified tiles mentioning their sizes that they are available in, naming their two manufactures/brands.
   IV. Importance of temporary timber structures like Shuttering and Scaffolding with alternative materials used for each one them these days.
2015-2016
B.Arch. (Winter Semester) Examination

Art and Graphics
AR 106
Maximum Marks: 40
Credits: 03
Duration: Three Hours

Present the graphics with proper colouring and rendering. Neat presentation of graphics and write-ups with proper examples and sketches carry additional weight-age within maximum marks.

1. What are attributes of a Good Design and Designer. Discuss importance of each in evaluation and creation of a Good Design. 10

2. Differentiate between any three of the following citing proper example with sketches.
   a) Functional and emotional values of art in architecture
   b) Additive and Subtractive Forms
   c) Collage and Mural
   d) Visual and Tactile textures
   15

3. Design, and render (in any medium) a Mural to be executed, on the internal wall of the building of Department of Architecture representing modern Architectural Education. Present its design to be executed with 1” x 1” glossy ceramic beads/tiles on half imperial sheet with half inch margin all around. Use of colours for beads is restricted to 4(+1 of background) only. 15
2015-16
B.ARCH. (WINTER SEMESTER) EXAMINATION
Architectural Drawing -II
AR 113

Maximum Marks: 40  Credits: 06  Duration: 3 Hours

Answer all the questions.
Assume suitable data if missing.
All dimensions are in mm.
Neat and good drafted drawings will be credited more.

Q.No.  Question                                                                                     M.M.
1     Draw perspective view of the object shown in figure-1.(Eye level = 35 mm)                      [25]
2     Draw siagrapy in front elevation of the object shown in figure -1 (Sun ray are inclined at <45° to
ground level in elevation and at <45° to vertical plane in plan.)                                    [15]
    OR                                                                                              
2'    Draw siagrapy in plan of the object shown in figure -1 (Sun ray are inclined at <45°
to ground level in elevation and at <45° to vertical plane in plan.)                               [15]

![Diagram of All Elevations and Plan with dimensions]
2015-16
B.ARC.H. (WINTER SEMESTER) EXAMINATION
B. ARCH. 1st YR
BASIC DESIGN
AR-151

Maximum Marks: 40  Credits: 04  Duration: Six Hours

Answer all the questions.
Support your answers with neat sketches.
Notations used have their usual meaning.

1. Derive anthropometrically the optimum size required for the following spaces showing necessary activities, furniture, required movement areas, etc.
   a) Dining Area for 10 persons
   b) Lavatory for a restaurant
   Drawing required to a scale of (1:20)
      i) Plan(s) with furniture / Fixture layout.

   OR

1’ Design a temporary structured advertisement booth for the purpose of advertisement of newly launched books by the faculty located in the premise of Maulana Azad Library, Aligarh Muslim University, Aligarh.
   Drawing required to a scale of (1:20)
      i) Plan/ Plans
      ii) Elevation/ View

2. Roadside restaurants in India is generally called Dhaba. They are situated on highways and generally serve local cuisine and also serve as truck stops. You are appointed as an Architect and asked to design a Dhaba for National Highway-28 with the following requirements

   A) Dining (open and covered)
   B) Cooking Area
   C) Cash Counter
   D) Lavatory
   E) Parking space for Two wheeler and Four wheeler

   Drawings required to a scale of (1:50)

      i) Viva
      ii) Plan/ Plans
      iii) Elevation/ View

(5) (15) (10)
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 M.M.

1(a) Write short notes on any two of the followings
   (a) Ethical use of bio-diversity
   (b) Consumptive exploitation of bio-diversity
   (c) Man-wildlife conflicts

1(b) What is population explosion? Discuss its environmental and ecological effects.

OR

1'(b) Write short notes on any two of the followings:
   (a) True sustainable development
   (b) Urban problems related to energy use
   (c) Water conservation

2(a) What do you mean by environmental ethics? Write the three principles of ethical
     conduct and prepare a case study citing Chipko movement.

2(b) How information technology can be beneficial to human health?

3(a) Discuss renewable and non renewable sources of energy? Write a short note on
     alternate sources of energy?

3(b) Explain land resources, land degradation and man induced landslides?

4(a) Explain the aims and Objectives of Environment Protection Act, 1986? Also briefly
     describe its important features.

OR

4'(a) Explain the aims and Objectives of water (Prevention and Control of Pollution) Act,
     1974? Also briefly describe its important features.

4(b) What is Ozone layer depletion? What emission from human activities leads to ozone
     depletion?

5(a) Discuss the Ecological Pyramid emphasizing on concept of energy flow and
    biomass. What is ecological succession?

OR

5'(a) What is biome and ecotones? Briefly discuss the different forest ecosystem.

5(b) What are lake ecosystem and its stratification? Classify the different types of lakes
     on the basis of their characteristics.

6(a) What are different physical, chemical and biological water quality parameters?

6(b) Explain the typical water treatment scheme for surface water source with diagram
2015-16

B.TECH. (WINTER 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 A

1(a) Determine the voltage across the 2Ω resistor by using Norton’s theorem. [05]

![Circuit Diagram 1(a)](image1)

OR

1(a') In the network shown, determine (a) the total impedance (b) the total current (c) the current in each branch. [05]

![Circuit Diagram 1(a')]()

1(b) What are hysteresis and eddy current losses? How they can be minimized. [05]

1(c) Draw equivalent circuit of primary and secondary sides of a single-phase transformer. Obtain equivalent circuit referred to primary side. [05]

Contd….2
2(a) Explain with the help of diagram the working of different types of moving iron instruments. [05]

OR

2(a') Explain with the help of diagram the working of induction type single-phase energy meter. [05]

2(b) What are the different types of induction motors? Also, explain the working principle of the three-phase induction motor. [05]

2(c) Draw the flue gas cycle of a coal fired steam plant and explain its components. [05]

PART B (to be answered in a separate copy)

3(a) Explain the formation of a potential barrier in a p-n junction and show the polarity of the Barrier potential. [07]

OR

3(a') Distinguish between avalanche and zener breakdown in p-n junction diode. [07]

3(b) Si- transistor with $\beta = 50$ is used in the circuit shown in Fig. 1, determine (i) $I_{CQ}$ (ii) $V_{CEQ}$ (iii) $I_{Csat}$ (iv) $I_{BO}$

![Fig. 1.](image)

4(a) Write a neat sketch to shown the construction of a depletion-enhancement MOSFET and explain its operation in both the modes. [07]

4(b) What is an integrator? Derive the formula for its output voltage. Explain its working with neat and clean waveform i) In case of square wave input ii) In case of sine wave input. [08]

OR

4(b') Design an operational amplifier circuit that will produce the output voltage $V_o = 0.1V_1 - 5V_2$. [08]
B.TECH. (WINTER SEMESTER) EXAMINATION
BASIC ELECTRONICS ENGINEERING
EL-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)       What are logic gates? Give circuit realization and truth table of OR and AND gates. [07]

1(b)       What are different characteristics of an ideal operational amplifier? Also explain the significance of virtual ground in an operational amplifier? [08]

OR

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

2(a)       Draw the equivalent circuits and characteristics of a PN junction diode for piecewise linear model and the constant voltage drop model. [08]

OR

2(a)'      Draw and explain the I-V characteristics of a Zener diode. What are the two breakdown mechanisms in a Zener diode? [08]

2(b)       What is rectification? Draw the circuit for a bridge rectifier, indicating the direction of current paths during positive and negative half cycles of input. [07]

3(a)       Explain the construction, working and characteristics of depletion mode MOSFET. Also explain the difference between enhancement and depletion MOSFET. [15]

OR

Contd.....2.
3(a)' Explain the constructional features, principle of operation and characteristics of N-channel JFET.

4(a) Explain the operation of NPN transistor with neat diagrams.

OR

4(a)' Explain input & output V-I characteristics of transistor in CE configuration

4(b) For the fixed-bias configuration, determine:
(a) $I_{EQ}$. (b) $I_{CQ}$. (c) $V_{CEQ}$. (d) $V_C$. (e) $V_B$. (f) $V_E$. 

[15] [07] [07] [08]
UNIT ONE

1. A) Read the following passage and answer the questions that follow: [3×2=10]

Engineers and their practices have been encouraged for one paramount reason: benefiting humankind. In modern society, we are constantly interacting with our environment. We harvest and extract all the resources that we need to sustain human life and culture in all its richness and complexity. It is the role of the engineer, however, to minimize the effects of damage on the surrounding ecosystems, and design necessary infrastructures that are both efficient and safe. In the media today, people are lured into believing that trinkets and stuff that sit on a shelf and collect dust will solve their woes. In reality, these things are not necessary and only serve to satisfy the selfish and competitive nature of humankind. Engineering focuses on the development of infrastructure that serves a meaningful purpose for humankind.

It may be said that the structures and processes engineers implement fall into four main categories: sustainability, safety, cleanliness, and connection. It is the role of the engineer to protect the environment and the people within it. Engineers aim to benefit the people of the present by employing effective structures that are intended to improve transportation and living habits of earth’s inhabitants. By extension, engineering is planning for the continual growth of the human population and ensuring there are sufficient resources for the people of the future. Engineers must be efficient, taking into consideration construction costs, time, and the wellness of people. In this respect, they are the role-model for multi-taskers everywhere! When designing a skyscraper or bridge, the team of engineers must ensure the safety of its users. Collapses cause panic and excessive stress. In a sense, adequate engineering ensures support and comfort, not only for the structures, but in the mind of the population. Engineering manages sewage, wastes, and purification. These points do affect sustainability, but they are also crucial in defining another aspect of engineering’s importance.

Contd.……..2
Cleanliness and public health are largely defined by engineering. Without proper engineering and sewage systems, we would no doubt run out of fresh water (much sooner than we are scheduled to), and we could quite literally be living in our own fecal matter. Finally, a significant focus of engineering is that of connection and globalization. As technology and design progresses, it is important that we keep in contact with the rest of the world. The saying ‘no man is an island’ quite literally comes into effect here. Without roads to get from point A to point B, or helicopters, or jets, the world would seem a very distant place. Technological advances have connected people across the globe in myriad, unforeseen ways. Essentially, engineering encourages a sense of awareness and togetherness.

Engineering serves as the calcium of society today. It continuously strengthens our pre-existing knowledge of design and, as calcium ensures healthy bones and teeth, engineering ensures a healthy and sustainable environment for humankind.

i) How does the passage categorize the goals of engineering?
ii) The passage asserts that an engineer should work to better humankind at the expense of the environment. State if this statement is true or false.
iii) What does the saying ‘No man is an island’ mean in the context of the passage?
iv) Do as directed:
   a) Engineering manages sewage, wastes, and purification. (Change into passive voice)
   b) Engineering focuses on the development of infrastructure that serves a meaningful purpose for humankind. (Replace the underlined with the appropriate ing-form)
v) The synonym of ‘myriad’ is
   a) Complex
   b) Innumerable
   c) Strange
   d) Unexpected

1. B) Write a paragraph summarizing the above passage. [10]

UNIT TWO

2. ‘All animals are equal, but some animals are more equal than others.’ Comment. [05]

OR

Explain the principles of Animalism in the novel Animal Farm.


OR

Discuss how Time is treated as the Fourth Dimension in the novel The Time Machine.

Contd......3
UNIT THREE

4. Answer any one of the following: [10]

Write a report on the recently held Annual Fest in the ZH College of Engineering and Technology at AMU.

OR

Describe the process of applying for admission to the B. Tech programme through the AMU website.

UNIT FOUR

5. Read the following passage and (i) Make notes of it; (ii) Write a precis of the same: [5\times2=10]

Breakthroughs in genetics present us with a promise and a predicament. The promise is that we may soon be able to treat and prevent a host of debilitating diseases. The predicament is that our newfound genetic knowledge may also enable us to manipulate our own nature—to enhance our muscles, memories, and moods; to choose the sex, height, and other genetic traits of our children; to make ourselves “better than well.” When science moves faster than moral understanding, as it does today, men and women struggle to articulate their unease. In liberal societies they reach first for the language of autonomy, fairness, and individual rights. But this part of our moral vocabulary is ill equipped to address the hardest questions posed by genetic engineering. The genomic revolution has induced a kind of moral vertigo.

Consider cloning. The birth of Dolly the cloned sheep, in 1997, brought a torrent of concern about the prospect of cloned human beings. There are good medical reasons to worry. Most scientists agree that cloning is unsafe, likely to produce offspring with serious abnormalities. (Dolly recently died a premature death.) But suppose technology improved to the point where clones were at no greater risk than naturally conceived offspring. Would human cloning still be objectionable? Should our hesitation be moral as well as medical? What, exactly, is wrong with creating a child who is a genetic twin of one parent, or of an older sibling who has tragically died—or, for that matter, of an admired scientist, sports star, or celebrity? Some say cloning is wrong because it violates the right to autonomy: by choosing a child’s genetic makeup in advance, parents deny the child’s right to an open future. A similar objection can be raised against any form of bioengineering that allows parents to select or reject genetic characteristics. According to this argument, genetic enhancements for musical talent, say, or athletic prowess, would
point children toward particular choices, and so designer children would never be fully free.

At first glance the autonomy argument seems to capture what is troubling about human cloning and other forms of genetic engineering. It is not persuasive, for two reasons. First, it wrongly implies that absent a designing parent, children are free to choose their characteristics for themselves. But none of us chooses his genetic inheritance. The alternative to a cloned or genetically enhanced child is not one whose future is unbound by particular talents but one at the mercy of the genetic lottery.

Second, even if a concern for autonomy explains some of our worries about made-to-order children, it cannot explain our moral hesitation about people who seek genetic remedies or enhancements for themselves. Gene therapy on somatic (that is, non-reproductive) cells, such as muscle cells and brain cells, repairs or replaces defective genes. The moral quandary arises when people use such therapy not to cure a disease but to reach beyond health, to enhance their physical or cognitive capacities, to lift themselves above the norm.

Like cosmetic surgery, genetic enhancement employs medical means for nonmedical ends—ends unrelated to curing or preventing disease or repairing injury. But unlike cosmetic surgery, genetic enhancement is more than skin-deep. If we are ambivalent about surgery or Botox injections for sagging chins and furrowed brows, we are all the more troubled by genetic engineering for stronger bodies, sharper memories, greater intelligence, and happier moods. The question is whether we are right to be troubled, and if so, on what grounds.

UNIT FIVE

6. Write an essay on any one of the following in about 300 words. [10]
   a) The importance of learning from the University of Life.
   OR
b) Self-help groups and social empowerment.
   OR
c) The future of engineering and technology.

***THE END###
B.TECH. (WINTER) II SEMESTER EXAMINATION
THERMAL SCIENCE
(ME-101)

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

NOTE: Answer all the questions, symbols have their usual meaning.
Assume suitable data if missing.
Use of steam table and charts are allowed.

1(a). Define the following terms: (i) Extensive & Intensive properties (ii) Zeroth law of thermodynamics (iii) Property.

1(b). A new scale of temperature N is divided in such a way that the freezing point of ice is 100°N and the boiling point is 400°N. What is the temperature reading on this new scale when the temperature is 150°C? What temperature both the Celsius and the new temperature scale reading would be the same?

1(c). Explain the working of two stroke engine with neat diagram.

2(a). A six cylinder, 4-stroke gasoline engine is run at a speed of 2520 rpm. The area of the indicator card of one cylinder is \(2.45 \times 10^{-3}\) mm\(^3\) and its length is 58.5\(\text{mm}\). The spring constant is \(20 \times 10^6\) N/m\(^3\). The bore of the cylinders is 140mm and the piston stroke is 150mm. Determine the indicated power, assuming that each cylinder contributes an equal power.

2(b). An electric generator coupled to a windmill produces an average electrical power output of 5 kW. The power is used to charge a storage battery. Heat transfer from the battery to the surrounding occurs at a constant rate of 0.6 kW. Determine the total amount of energy stored in the battery, in kWh, in 8-hour operation.

2(c). What is the purpose of throttling device? Apply SFEE across the throttling device and show that enthalpy before and after throttling are equal.

OR

2′(a). A long well insulated pipeline consists of two pipes connected in series, the internal diameters of which are 90mm and 30mm respectively. A steady flow of steam enters the 90mm diameter pipe at a pressure of 350 kPa, a specific volume of 0.684 m\(^3\)/kg, and an enthalpy of 2980 kJ/kg. At a point downstream in the 30mm diameter pipe, the pressure is 300 kPa, the specific volume is 0.790 m\(^3\)/kg and the enthalpy 2968 kJ/kg. Determine the velocity of steam, at the two points in the pipeline and the mass flow rate of the steam.

Contd....2.
2(b). Define enthalpy. Why does the enthalpy of an ideal gas depend only on temperature. Also show that heat transfer at constant pressure is equal to change in enthalpy in a closed stationary system.

3(a). Draw different phase regions on p-v diagram for pure substance (water). Show few isotherms, mark triple point and critical point.
3(b). What do you understand by degree of superheat and degree subcooling.
3(c). Why a throttling calorimeter cannot measure the quality of steam if the steam is very wet. How is the quality measured then?
3(d). Steam initially at 0.3 MPa, 250°C is cooled at constant volume. What is the quality at 80°C? What is the heat transferred per kg of steam in cooling from 250°C to 80°C?

4(a). Differentiate Refrigerator and heat pump with working cycle. Also show that COP of heat pump is greater than COP of refrigerator by unity.
4(b). What is PMM2? State Clausius statement of second law.
4(c). A reversible heat engine operating between thermal reservoirs at 800°C and 30°C drives a reversible refrigerator which refrigerates a space at -15°C and delivers heat to a thermal reservoir at 30°C. The heat input to the heat engine is 1900 kJ and there is a net work output from the combined heat engine and refrigerator plant of 290 kJ. Determine the heat transfer to the refrigerant and the total heat transfer to the 30°C thermal reservoir.

OR

4'. An engine working on Otto cycle is supplied with air at 0.1 MPa, 35°C. The compression ratio is 8. Heat supplied is 2100 kJ/kg. Calculate the maximum pressure and temperature of the cycle, the cycle efficiency, and the mean effective pressure. (For air, $C_p=1.005$, $C_v=0.718$, and $R=0.287$ kJ/kg K). Show cycle on P-v and T-s diagram.

5(a). Explain the working of Rankine cycle, draw the cycle on T-S diagram and apply SFEE across each component and hence evaluate efficiency.
5(b). Define entropy and explain principle of increase of entropy.
5(c). Explain thermodynamic temperature scale.
B.TECH. (WINTER SEMESTER) EXAMINATION
MECHANICAL ENGINEERING
ENGINEERING GRAPHICS
ME- 102

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.  
1  
Question: Construct a diagonal scale to show metres, decimetres, and centimetres and long enough to measure upto 6 metres when 1 metre is represented by 2.5 centimetres. Find R.F. and indicate on the scale, a distance of 4 metres, 5 decimetres and 6 centimetres.

M.M. [08]

2  
Question: A straight line AB, 70 mm long, has its front view inclined at 45° to the H.P. The point A is in the V.P., and 20 mm above xy line. The length of the front view is 35 mm. Draw the top view of the line and find its true inclination to H.P. and V.P.

OR

2'  
Question: Draw the projections of a circular lamina of 50 mm diameter, whose centre is 30 mm from H.P. and 20 mm in front of V.P. The circular lamina is inclined at an angle of 30° to H.P. and perpendicular to V.P.

M.M. [08]

3  
Question: Figure 1 shows a sketch of the adjuster. Draw to full size the following views:
(a) Front view(elevation)- F  
(b) Side view(end view)- S  
(c) top view( plan)- T.

OR

M.M. [12]

3'  
Question: Figure 2 shows a cast iron block. Draw the following views to a full scale:
(a) Half sectional elevation, (b) Half sectional end view, (c) Top view

M.M. [12]

Contd....2.
Figure 3 shows an object. Draw isometric view of this object.
Max Marks: 60

1. (a) Two forces are applied as shown fig 1 to a hook support. Knowing that the magnitude of P is 35N, determine by trigonometry (a) the required angle $\alpha$ if the resultant $R$ of the two forces applied to the support is to be horizontal, (b) the corresponding magnitude of $R$.

(b) Neglecting friction, determine the tension in cable ABD and the reaction at C when $\theta = 45^0$ (Refer fig. 2).

OR

(b') The cylinder shown in fig 3 is of weight $W$ and radius $r$, and the coefficient of static friction $\mu_s$ is the same at A and B. Determine the magnitude of the largest couple $M$ which can be applied to the cylinder if it is not to rotate.

2. (a) Determine by direct integration the centroid of area shown in fig. 4. Express your answer in terms of $a$ and $b$.

(b) Determine the moment of inertia of the shaded area shown in fig. 5 with respect to the x-axis.

OR

(b') Derive an expression for the magnitude of the couple $M$ required to maintain the equilibrium of the linkage shown in fig. 6.

3. (a) A spring AB of constant k is attached to a support at A and to a collar of mass m. The unscratched length of the spring is $l$. Knowing that the collar is released from rest at $x = x_0$ and neglecting friction between the collar and the horizontal rod, determine the magnitude of the velocity of the collar as it passes through point C (Refer fig. 7)

(b) Water flows from a drain spout with an initial velocity of 0.75 m/s at an angle of $15^0$ with the horizontal. Determine the range of values of the distance $d$ for which the water will enter the trough BC (Refer fig. 8).

OR

(b') Two blocks A and B of mass 4 Kg and 5 Kg respectively, are connected a cord which passes over pulleys as shown in fig 9. A 3 Kg collar C is placed on block A and the system is released from rest. After the blocks have moved 0.9m, collar C is removed and blocks A and B continue to move. Determine the speed of block A just before it strikes the ground (Refer fig. 9.)
4. (a) A system 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, \( V_A = 4i + 2j + 2k, \) \( V_B = 4i + 3j \) and \( V_C = -2i + 4j + 2k. \)

Determine the angular momentum \( \mathbf{H}_0 \) of the system about \( O \) (Refer fig. 10)

(b) In a game of pool, ball A is moving with a velocity \( V_0 \) of magnitude \( v_0 = 5 \text{m/s} \) when it strikes balls B and C, which are at rest and aligned as shown in fig. 11. Knowing that after the collision the three balls move in the directions indicated and assuming frictionless surfaces and perfectly elastic impact (i.e. conservation of energy), determine the magnitudes of the velocities \( V_A, V_B \) and \( V_C. \)

5. (a) Collar A moves upward with a constant velocity of \( 1.2 \text{ m/s} \). At the instant shown when \( \theta = 25^0 \), determine (a) the angular velocity of rod AB, (b) the velocity of Collar : B. (Refer fig. 12)

(b) A pulley weighing \( 50 \text{ Kg} \) and having a radius of gyration of \( 0.4 \text{ m} \) is connected to two blocks as shown in fig. 13. Assuming no axle friction, determine the angular acceleration of the pulley and the acceleration of each block.

OR

(b') Each of the gears A and B has a mass of \( 2.4 \text{ Kg} \) and a radius of gyration of \( 60 \text{mm} \), while gear C has a mass of \( 12 \text{ Kg} \) and a radius of gyration of \( 150 \text{ mm} \). A couple \( M \) of constant magnitude \( 10 \text{ N.m} \) is applied to gear C. Determine (a) the number of revolutions of gear C required for its angular velocity to increase from \( 100 \) to \( 450 \text{ r/min} \), (b) the corresponding tangential force acting on gear A. (Refer fig. 14)

****

Figures enclosed.

cont'd... 3
2015-16
B.TECH./B. ARCH. WINTER SEMESTER
(II 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.

1(a) The assembly shown in Fig. 1 is welded to collar A that fits on the vertical pin shown. The pin can exert couples about the x and z axes but does not prevent motion about or along the y-axis. For the loading shown, determine the tension in each cable and the reaction at A.

1(b) A 15° wedge is forced under a 50kg pipe as shown in Fig. 2. The coefficient of static friction at all surfaces is 0.20. (a) Show that slipping will occur between the pipe and the vertical wall. (b) Determine the force P required to move the wedge.

2(a) The two-dimensional motion of a particle is defined by the relations \( r = 2a \cos \theta \) and

Contd.....2.
\[ \theta = bt^2/2 \], where \( a \) and \( b \) are constants. Determine (a) the magnitudes of the velocity and acceleration at any instant, (b) the radius of curvature of the path. What conclusion can you draw regarding the path of the particle?

2(b) Two hemispheres shown in Fig. 3 are held together by a cord which maintains a spring under compression (the spring is not attached to the hemispheres). The potential energy of the compressed spring is 120 J and the assembly has an initial velocity \( v_o \) of magnitude \( v_o = 8 \text{ m/s} \). Knowing that the cord is severed when \( \theta = 30^\circ \), causing the hemispheres to fly apart, determine the resulting velocity of each hemisphere.

OR

2(b)' In a game of billiards (Fig. 4), ball A is given an initial velocity \( v_o \) along the longitudinal axis of the table. It hits ball B and then ball C, which are both at rest. Balls A and C are observed to hit the sides of the table squarely at \( A' \) and \( C' \), respectively, and ball B is observed to hit the side obliquely at \( B' \). Knowing that \( v_o = 4 \text{ m/s} \), \( v_A = 1.92 \text{ m/s} \) and \( a = 1650 \text{ mm} \), determine (a) the velocities \( v_B \) and \( v_C \) of balls B and C, (b) the point \( C' \) where ball C hits the side of the table. Assume frictionless surfaces and perfectly elastic impacts (that is, conservation of energy).
3(a) Collar $A$ moves upward with a constant velocity of 1.2 m/s. At the instant shown in Fig. 5 when $\theta = 25^\circ$, determine (a) the angular velocity of rod $AB$, (b) the velocity of collar $B$.

3(b) A driver starts his car (Fig. 6) with the door on the passenger’s side wide open ($\theta = 0^\circ$). The 40kg door has a centroidal radius of gyration $k = 300$ mm and its mass center is located at a distance $r = 500$ mm from its vertical axis of rotation. Knowing that the driver maintains a constant acceleration of 2 m/s$^2$, determine the angular velocity of the door as it slams shut ($\theta = 90^\circ$).

![Fig. 5](image)

**Fig. 5**

**OR**

3(b)' The motion of the 3kg uniform rod $AB$ is guided by small wheels of negligible weight that roll along without friction in the slots shown. If the rod is released from rest in the position shown, determine immediately after release (a) the angular acceleration of the rod, (b) the reaction at $B$.

![Fig. 7](image)

**Fig. 7**
SECTION-B

4(a) Define strain hardening, isotropic and homogeneous. A cylinder bar is 2 cm in diameter and 100 cm long. During a tensile test it is found that the longitudinal strain is 4 times the lateral strain. Calculate the modulus of rigidity and the bulk modulus if its elastic modulus is 100 GPa. Find the change in volume, when the bar is subjected to a hydrostatic pressure of 100 MPa.

4(b) A steel rod 20 mm diameter is passed through a brass tube of 25 mm internal diameter and 30 mm external diameter. The tube is 80 cm long and is closed by thin rigid washers and fastened by nuts, screwed to the rod. The nuts are tightened until a compressive force in the tube is 5 kN. Calculate the stresses in the rod and in the tube. Take $E_b = 200$ GPa and $E_s = 80$ GPa.

4(c) A hollow shaft of diameter ratio 3/8 is to transmit 375 kW at 100 rpm, the maximum torque being 20% greater than the mean torque. The shear stress is not exceeding 60 N/mm$^2$ and the twist in a length of 4 m is not to exceed 2°. Calculate its external and internal diameters which would satisfy both the above conditions. Take Modulus of rigidity $= 8.5 \times 10^4$ N/mm$^2$.

OR

4(c)' At a point in a material, there are two normal tensile stresses of magnitude 20 MPa and 10 MPa acting mutually perpendicular to each other. A positive shear stress of 5 MPa is also acting at that point. Determine the normal and shear stress on a plane whose normal is inclined at 60° to 20 MPa stress.

5(a) A cantilever beam of length 2 meter fails when a load of 2 kN is applied at the free end. If the section of the beam is 40 mm × 60 mm, find the stress at failure.

5(b) Draw the shear force and bending moment diagram for the beam shown in figure below.

\[\text{Diagram of Beam}\]

OR

5(b)' Draw the shear force and bending moment diagram for the beam shown in figure below.

\[\text{Diagram of Beam}\]