

**UNIVERSITY OF PUNE**  
**[4361]-03**  
**F. E. (Semester-I) Examination-2013,**  
**APPLIED SCIENCE-I (PHYSICS)**  
**(2008 Course)**

**Total No. of Questions : 6**                      **[Total No. of Printed Pages :6]**  
**[Time : 2 Hours]**                                      **[Max. Marks : 50]**

**Instructions :** (1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6.

(2) Neat diagram must be drawn wherever necessary.

(3) Black figures to the right indicate full marks.

(4) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(5) Assume suitable data, if necessary.

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Constants:                       $h = 6.63 \times 10^{-34} \text{ J}\cdot\text{sec}$   
                                       $c = 3 \times 10^8 \text{ m/s}$   
                                       $e = 1.6 \times 10^{-19} \text{ C}$   
                                       $m_e = 9.1 \times 10^{-31} \text{ kg}$

Q1.

- a) With the help of neat labeled diagram explain the principle, construction and working of Michelson's interferometer, Discuss the types of fringes. [7]
- b) Obtain an expression for the displacement when a transverse magnetic field acts on an electron in a limited region [6]
- c) A parallel beam of light  $\lambda = 5890 \text{ \AA}$  is incident on a glass plate ( $\mu = 1.5$ ) such that angle of refraction into plate is  $60^\circ$ . Calculate the smallest thickness of the plate which will make it appear dark by reflection. [4]

OR

Q2.

- a) What is velocity selector? How this principle is used in Bainbridge mass spectrograph to determine the mass of the isotopes? [7]
- b) A thin film of uniform thickness is illuminated by monochromatic light. Obtain the conditions of darkness and brightness of the film as observed in reflected light [6]
- c) Electrons accelerated by a potential difference of 150 volt enter in an electric field at an angle of  $50^\circ$  with normal to the interface of the higher potential and get refracted at an angle of  $35^\circ$  with the normal. Find the potential difference between the two regions. [4]

Q3.

- a) Explain the Fraunhofer diffraction at a single slit and obtain the condition for principal maximum and minima. Draw the intensity distribution curve. [7]
- b) What is Piezo-electric Effect? Describe with a neat diagram the Piezo-electric oscillator for generating the ultrasonic waves [6]
- c) How many orders will be visible if the wavelength of the incident light is  $6000\text{\AA}$  and the number of lines in the grating is  $5.0 \times 10^3$  lines per cm. [4]

OR

Q4.

- a) What is Ultrasonics? Explain magnetostriction oscillator for production of ultrasonic waves. [7]
- b) State Rayleigh's criterion of resolution hence obtain an expression for the resolving power of grating [6]
- c) An ultrasonic pulse of frequency  $80\text{KHz}$  is sent down towards the seabed. The echo is recorded after  $0.7$  sec. if the velocity of sound in sea water is  $1500\text{ m/s}$  calculate the depth of the sea and the wave length of the pulse [4]

Q5.

- a) Distinguish between polarized and unpolarised light. Describe the process of production and defection of elliptically polarized light. [6]
- b) With the help of a neat labelled diagram, explain, construction and working of a cyclotron. Obtain the expression for cyclotron frequency and maximum energy of the particle. [6]
- c) Calculate thickness of a mica plate required to make a quarter wave plate and half wave plate for light of wavelength  $5890\text{\AA}$ . [4]  
Given:  $\mu_0 = 1.586$  and  $\mu_e = 1.592$

OR

Q6.

- a) What is meant by nuclear fusion? Give an account of carbon-nitrogen cycle in fusion reaction. [6]
- b) Explain the term double refraction and hence explain the phenomenon of it on the basis of Huygen's wave theory [6]
- c) In a betatron the maximum magnetic field transversing the electron orbit is  $0.8\text{ wb/m}^2$ . The operating frequency of it is  $50\text{Hz}$  and the stable orbit diameter is  $0.8\text{m}$ . calculate the average energy gained per revolution and the final energy of electron assuming maximum possible time for acceleration. [4]

**UNIVERSITY OF PUNE**  
**[4361]-6**  
**F. E. (Semester-I) Examination-2013**  
**Engineering Graphics-I**  
**(2008 Pattern)**

**[Total No. of Questions : 12]**

**[Total No. of Printed Pages :7]**

**[Time: 4 Hours]**

**[Max. Marks: 100]**

**Instructions :**

- (1) Answer **one** question from each unit. Answer **three** questions from section-I and **three** sections from section-II.*
- (2) Answers to the **two sections** should be drawn on **separate drawing-sheet**.*
- (3) Use only half imperial size drawing papers as answer sheets.*
- (4) Assume suitable data if necessary and retain all construction lines*

**SECTION-I**

**UNIT-II: ENGINEERING CURVES**

**Q1.**

- a) Draw an ellipse by rectangular method, if the major and minor axes are 100 mm and 60mm respectively. [8]
- b) Draw an Archimedian spiral for one convolution, given that the radius is 60 mm. [7]

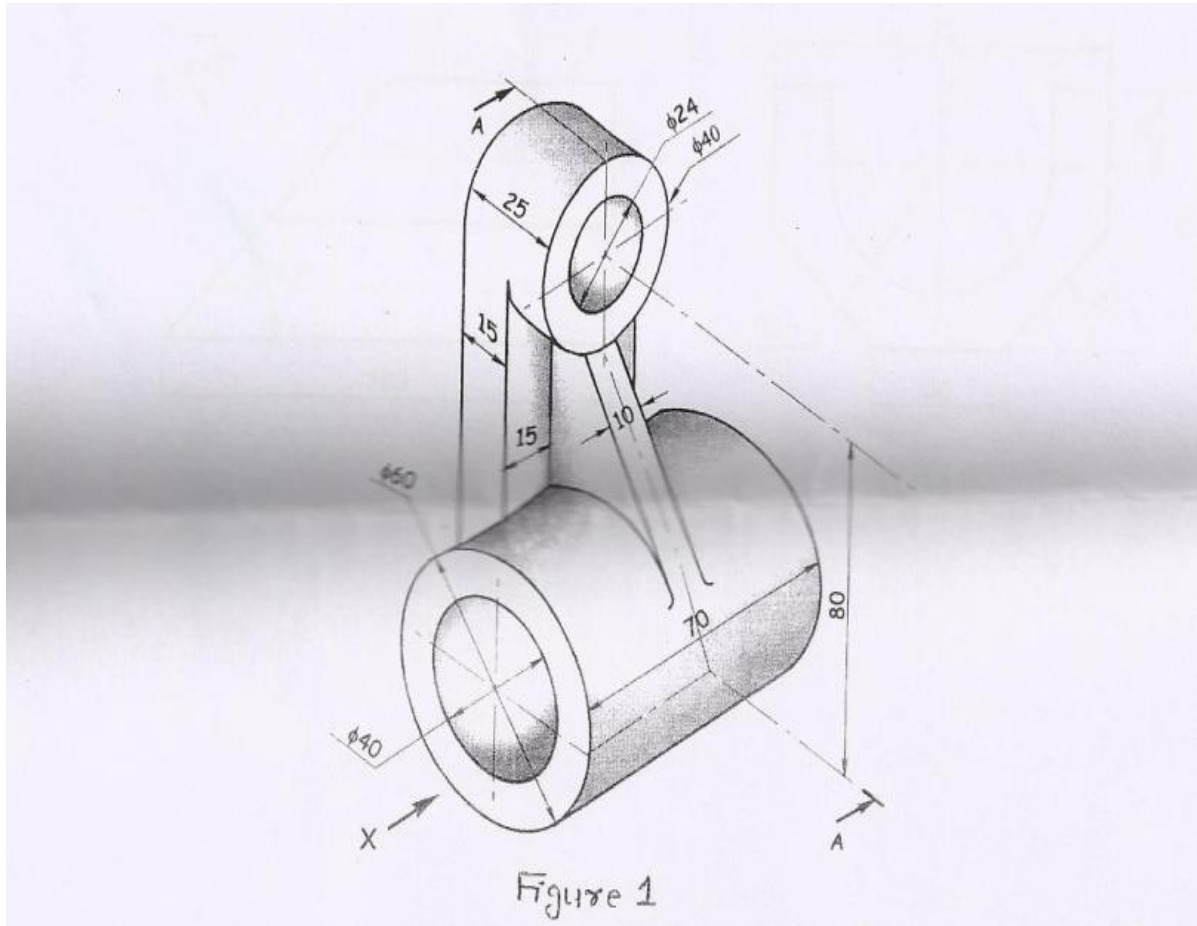
**OR**

**Q2.**

- a) Construct a hyperbola by focus-directrix method, if the distance of focus from the directrix is 60 mm and eccentricity  $3/2$ . [8]
- b) Draw a cycloid of rolling circle of diameter 60 mm. [7]

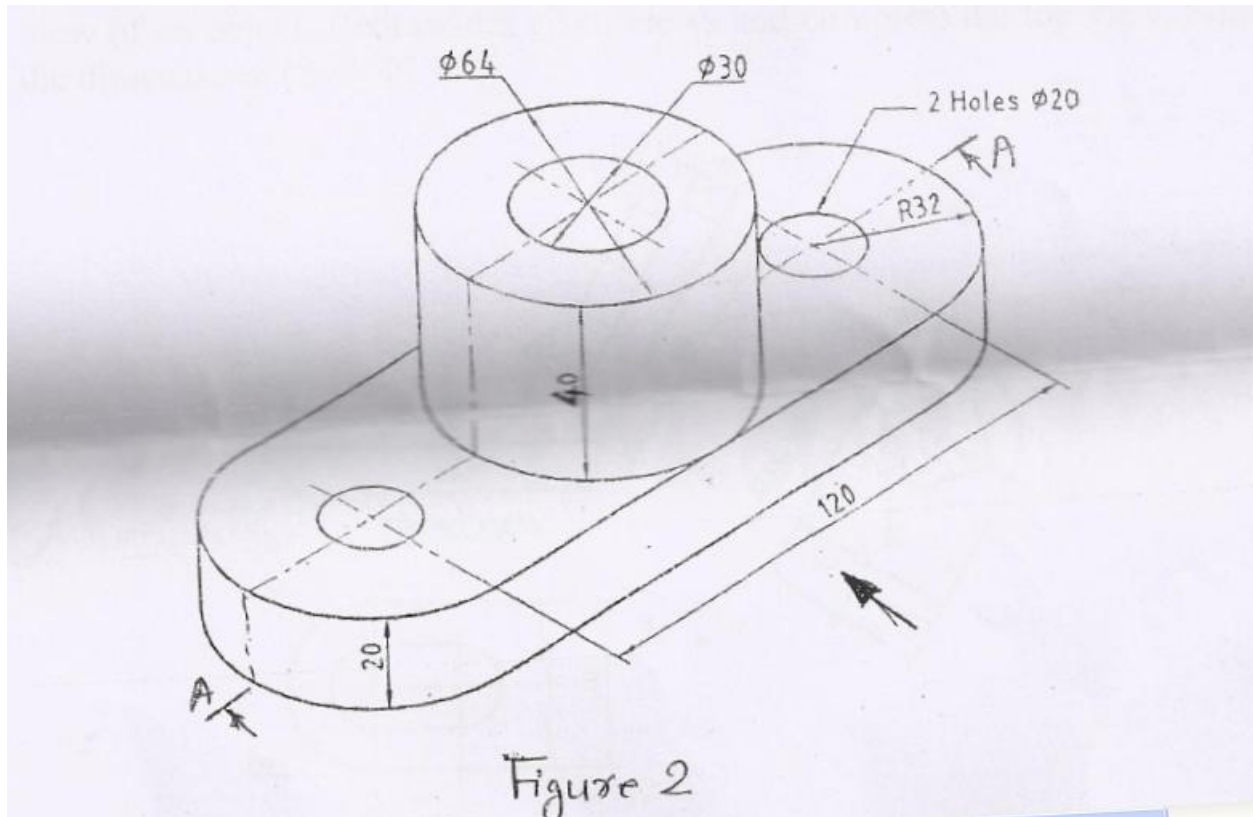
### UNIT-III: ORTHOGRAPHIC PROJECTIONS

Q3. Figure 1 shows a pictorial view of an object. Draw sectional elevation along section A-A, plan and right side view. Give the dimensions. [6+6+6+2] [20]



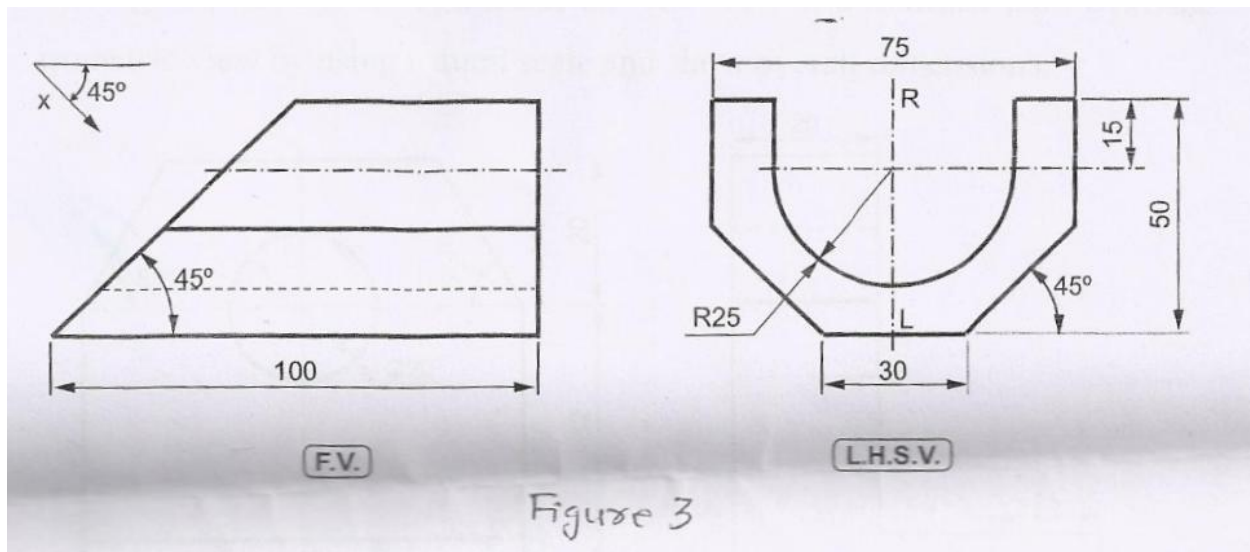
OR

Q4. Figure 2 shows a pictorial view of a bracket. Draw sectional elevation along sectional A-A, plan and left side view. Give the dimensions. [6+6+6+2] [20]



#### UNIT-IV: AUXILIARY PROJECTIONS

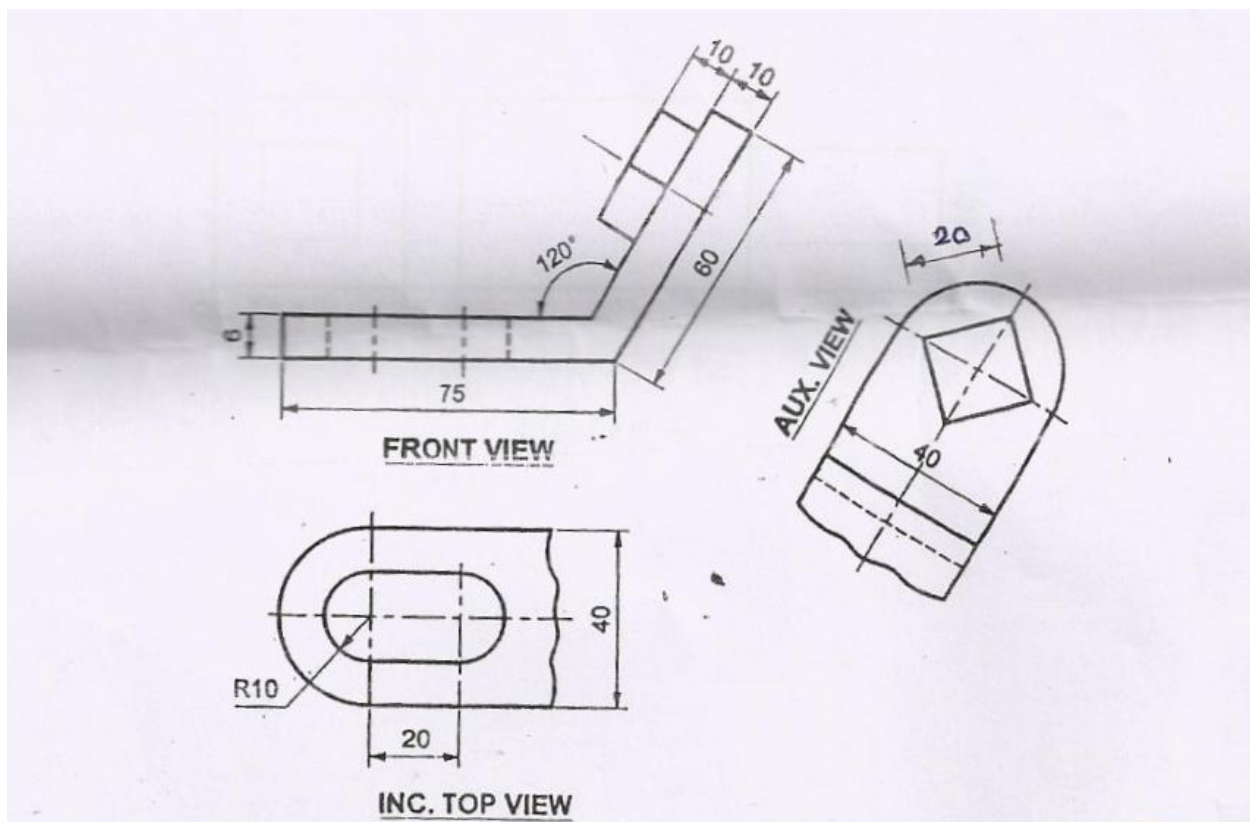
Q5. Figure 3 shows front view and left side view of an object. Redraw the given view and draw an auxiliary view in the direction of X as shown in figure. Show the dimensions. [5+8+2]. [15]



OR

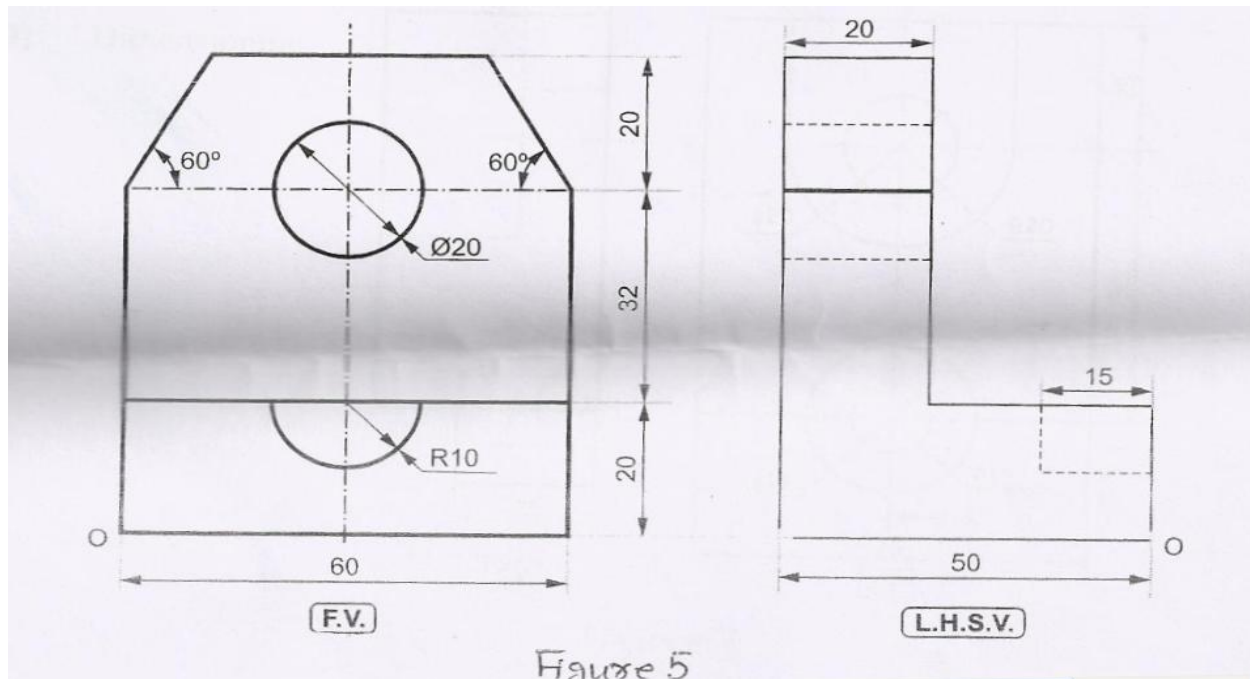
Q6. Figure 4 show front view, incomplete top view and incomplete auxiliary view of an object. Redraw the given views and complete the top view. Show the dimension. [5+8+2].

[15]



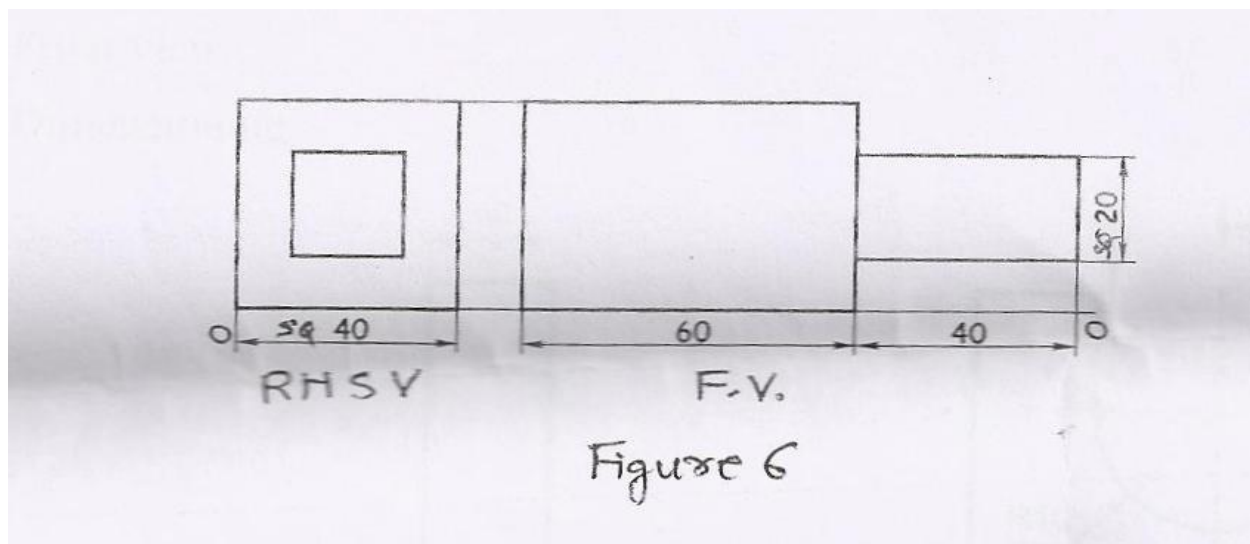
**SECTION-II**  
**UNIT-V: ISOMETRIC.**

Q7. The figure 5 shows front view and left end view of a machine part. Draw its isometric view by using natural scale and show overall dimensions. [20]



OR

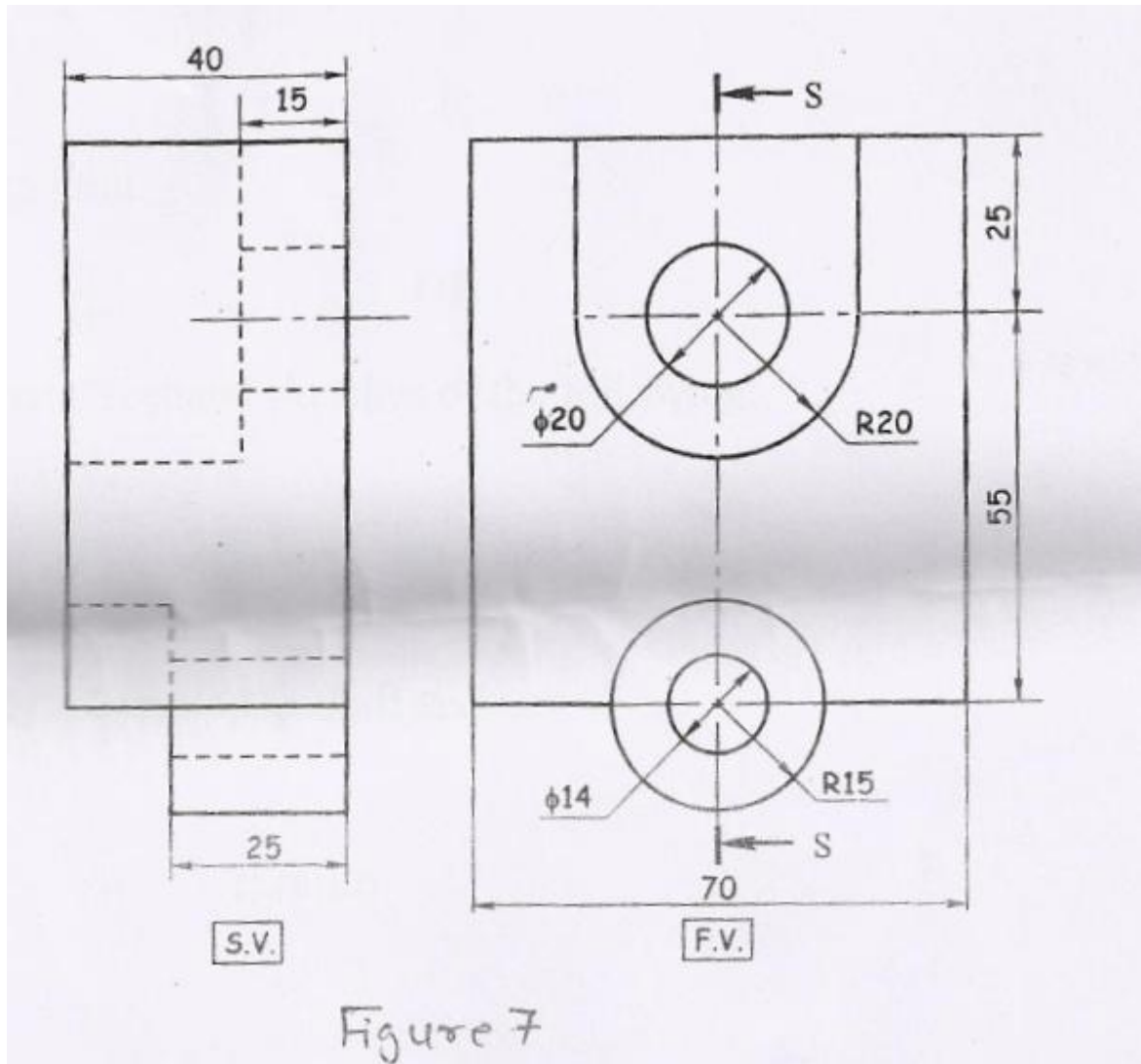
Q8. The figure 6 shows front view and right hand side view of machine part. Draw its isometric projections by using isometric scale. [20]





## UNIT-VI: MISSING VIEWS

- Q9. The figure 7 shows front view and side view of a machine part. Draw [20]
- a) Sectional side view, along section S-S [7]
  - b) Top view [7]
  - c) Front view [3]
  - d) Dimensioning [3]



OR



Q10. The figure 8 shows front view and right side view of a machine part.

Draw

[20]

a) Sectional side view, along section A-A

[7]

b) Top view

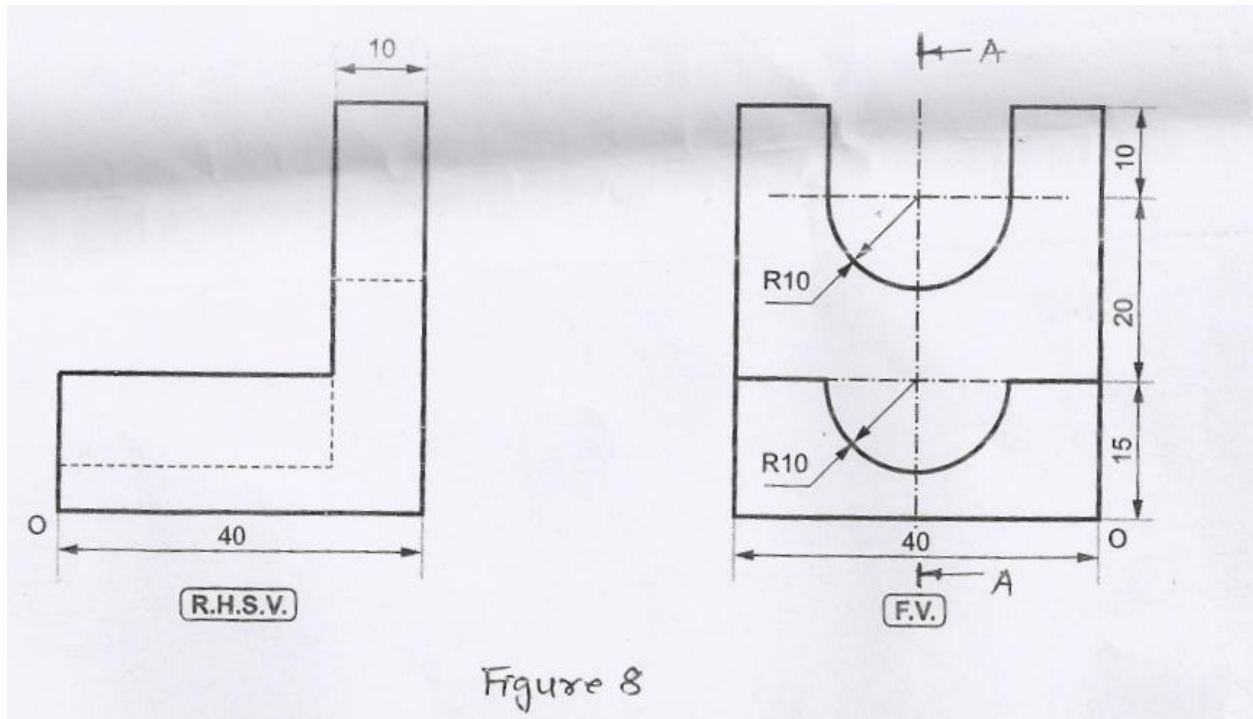
[7]

c) Front view

[3]

d) Dimensioning

[3]



### UNIT-VII: FREE HAND SKETCHES

Q11. Draw freehand sketches of the following:

[10]

A) Square thread

[3]

B) Leaf spring

[3]

C) Single riveted lap joint

[4]

OR

Q12. Draw proportionate freehand sketches of the following:

[10]

a) Square nut

[3]

b) Lifting eye bolt

[3]

c) Gib-headed Key assembled in shaft and hub

[4]

**UNIVERSITY OF PUNE**

**[4361]-9**

**F. E. (Common)**

**Applied Science-II**

**Physics**

**(2008 Pattern)**

**Total No. of Questions : 6**  
**[Time : 2 Hours]**

**[Total No. of Printed Pages :2]**  
**[Max. Marks : 50]**

***Instructions :***

- (1) Neat diagram must be drawn wherever necessary.*
- (2) Black figures to the right indicate full marks.*
- (3) Your advised to attempt not more than 03 questions.*
- (4) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- (5) Assume suitable data, if necessary.*

Constants :

Velocity of light ( $c$ ) =  $3 \times 10^8$  m/sec.

Mass of electron ( $m$ ) =  $9.1 \times 10^{-31}$  kg

Charge on electron ( $e$ ) =  $1.6 \times 10^{-19}$  C

Planck's constant ( $h$ ) =  $6.625 \times 10^{-34}$  J-S

Q1.

- a) Explain how the wave group is formed, and obtain an expression for a group velocity. [7]
- b) Explain in short, why  $\psi$  is not directly related with probability and obtain Schrodinger's time dependent wave equation [6]
- c) Obtain Heisenberg's uncertainty principle in terms of energy and time [4]

**OR**

Q2.

- a) Derive an expression for the energy levels and wave functions of a particle enclosed within infinite deep potential well. Draw the probability distribution curves. [7]

- b) State Heisenberg's uncertainty principle and establish it with the help of single slit diffraction experiment [6]
- c) For the particle moving with non-relativistic energy, show that the group velocity is equal to the particle velocity. [4]

Q3.

- a) State the properties of Laser and explain construction and working of solid state laser. [7]
- b) Explain following properties of superconductors.
  - 1) Critical magnetic field [3]
  - 2) Critical current density. [3]
- c) State the advantages of optical fiber communication technology over the conventional methods [4]

**OR**

Q4.

- a) What is holography? State its principle. Explain the process of holography recording and reconstruction [7]
- b) Explain the Meissner effect. Show that superconductors are perfect diamagnet. [6]
- c) Explain with the help of energy level diagram [4]
  - 1) Spontaneous emission &
  - 2) Stimulated emission.

Q5.

- a) What is Hall effect? Obtain an expression for Hall voltage and Hall coefficient. State applications of Hall effect. [6]
- b) Explain any two properties nanoparticles. [6]

- c) Calculate the conductivity of pure silicon at room temperature when the concentration of carriers is  $1.5 \times 10^{16}/\text{m}^3$  and the mobilities of electrons and holes are 0.12 and 0.05  $\text{m}^2/\text{v}\cdot\text{sec}$  respectively at room temperature. [4]

**OR**

Q6.

- a) Explain principle, construction and working of solar cell. Explain its characteristic curve [6]
- b) Explain with neat labeled diagram the synthesis of metal nanoparticles by colloidal route. [6]
- c) A silver wire is in the form of a ribbon 0.50cm wide and 0.10 mm thick. When a current of 2Amp passes through the ribbon perpendicular to a 0.80 Tesla magnetic field, how large a hall voltage is produced along the width? The density of silver is  $10.5 \text{ gm}/\text{cm}^3$ .  
(At.wt of silver = 108) [4]

**UNIVERSITY OF PUNE**  
**[4361]-11**  
**F. E. Examination – 2013**  
**Basic Mechanical Engineering**  
**(2008 Course)**

[Time: 3 Hours]

[Max. Marks: 100]

**Instructions:**

- (1) Solve Q1 or Q2, Q3 or Q4, Q5 or Q6 Q7 or Q8, Q9 or Q10, Q11 or Q12.
  - (2) Answers to the **two sections** should be written in **separate answer-books**.
  - (3) Black figures to the right indicate full marks.
  - (4) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
  - (5) Assume suitable data, if necessary.
- 

**SECTION-1**

- Q. 1. A) Define  $C_p$ ,  $C_v$ , Enthalpy, internal Energy. (2\*4)  
B) Explain Joules Experiment and the statement with neat sketch (3+3+2)

**OR**

- Q.2. A) Differentiate Open and closed systems with 2 examples of each (4+4)  
B) State Kelvin plank's statement of 2<sup>nd</sup> law of thermodynamics with (4+4) neat sketch. An engine is supposed to produce 1000 W of mechanical work operating with efficiency of 49%. Determine the amount of heat supplied by source and Heat rejected to sink.

- Q.3. A) Define Mounting and accessories and List 3 mountings and 3 accessories. (4+4)  
B) Draw neat sketch of window air conditioner and explain the working. (4+4)

**OR**

- Q. 4. A) Draw block diagram of: Reaction turbine and reciprocating compressor. (4+4)

- B) Draw neat sketch of two stroke petrol engine explain the working (4+4)
- Q.5. A) Explain Hydroelectric power plant with neat sketch. (4+4)  
 B) Explain conductivity and insulation and give examples. (4+4)  
 C) Example Fourier's law. (2)

**OR**

- Q.6. A) Explain wind power plant with neat sketch (4+4)  
 B) Explain Newton's law of cooling. Hot air at 150°C flows over one side of plate maintained at 50°C. Forced convection heat transfer heat transfer coefficient is 76W/m<sup>2</sup>K. Calculate the heat gain rate by the plate through an area of 2 m<sup>2</sup>. (4+4)  
 C) Mention energy conversion type between water in Dam- Turbine- Alternator. (2)

## **SECTION -2**

- Q. 7. A) Classify bearing and explain Collar bearing with sketch. (4+4)  
 B) Define Coupling, types of couplings and List application of couplings. (4+4)

**OR**

- Q. 8. A) Define shaft, types of shafts. List applications of shaft. (2+3+3)  
 B) State function of governor and explain working of Watt governor. (4+4)
- Q. 9. A) Define Hardness, Tensile strength, malleability, Elasticity. (2\*4)  
 B) Explain Sand casting process with neat sketch. (4+4)

**OR**

- Q. 10. A) State applications of ceramics, plastics, rubber and composite. (2\*4)  
 B) Explain any 4 sheet metal operations with sketches. (2\*4)
- Q. 11. A) Draw a neat sketch of lathe machine and explain 2 operations with sketch. (4+4)  
 B) Explain Internal Grinding operation with sketch. (4+4)  
 C) Define CNC. (2)

**OR**

- Q.12. A) Sketch and Explain drilling operations. (2\*4)  
 B) Explain with block diagram NC machine and 2 applications. (4+4)  
 C) Sketch Gang Milling operation . (2)

**UNIVERSITY OF PUNE**  
**[4361]-2**

**F. E. Examination-2013**  
**Engineering Chemistry**  
**(2008 Pattern)**

**Total No. of Questions : 6**  
**[Time : 2 Hours]**

**[Total No. of Printed Pages :2]**  
**[Max. Marks : 50]**

***Instructions***

- (1) Answer only three question from each section.*
- (2) Answers to the **two sections** should be written in **separate answer-books**.*
- (3) Neat diagram must be drawn wherever necessary.*
- (4) Figures to the right indicate full marks.*
- (5) Use of logarithmic tables or electronic pocket calculator is allowed.*
- (6) Assume suitable data, if necessary.*

Q1.

- a) State the law of constant elements of symmetry. Show that cubic lattice crystal exhibit 23 elements of symmetry. [07]
- b) Explain in brief about Schottky and Frenkel defects of ionic solids. [06]
- c) At what glancing angle would the first order diffraction from (110) plane of KCl observed using x-rays of wavelength of 180 pm. The dimension of the unit cell is 320 pm. [04]

OR

Q2.

- a) Define Atomic Packing Factor (APF). Prove that APF for BCC is 0.86 and that for FCC is 0.74 [07]
- b) Explain structural features, properties and applications of Fullerene [06]
- c) Define radius ratio and show that radius ratio for ionic crystal with CN-03 is 0.155. [04]



Q3.

- a) Explain with examples strong acid and weak base titration with titration curve diagram and formulae to calculate pH at different stages. [07]
- b) Calculate equivalent weight of  $\text{KMnO}_4$  in acidic, basic and neutral medium. [06]
- c) Define [04]
  - 1) Normality
  - 2) Equivalence point
  - 3) Primary standard
  - 4) Molality

OR

Q4.

- a) Explain titration between  $\text{CH}_3\text{COOH}$  and  $\text{NaOH}$  with titration curve diagram and formulae to calculate pH at different stages. [07]
- b) Define precipitation titration. Explain Mohr's methods to determine chloride content. [06]
- c) 100 ml of 0.1 N  $\text{NH}_4\text{OH}$  ( $K_a = 1.2 \times 10^{-8}$ ) is used to titrate with 0.2 N  $\text{HCl}$ , calculate pH of titration mixture at 30 ml and 50 ml  $\text{HCl}$  added stage. [04]

Q5.

- a) Define chain polymerization reaction and explain its free radical mechanism. [06]
- b) Give synthesis, properties and application of PVC and ABS. [06]
- c) Write a note on Glass transition temperature. [04]

OR

Q6.

- a) Define vulcanization. Explain vulcanization of rubber with its change in properties and structural changes. [06]
- b) Distinguish LDPE and HDPE in reference of its synthesis, properties and applications [06]
- c) Write a note on biodegradable polymers. [04]

Total No. of Questions : 12

[Total No. of Printed Pages :4]

**F.E. Examination – 2013**  
**Basic Electrical Engineering**  
**[4361]-4**  
**(2008 Pattern)**

[Time : 3 Hours]

[Max. Marks : 100]

**Instructions :**

- (1) Answer *Q.No.1 or 2 Q.No. 3 or 4 Q.No. 5 or 6, Q.No.7 or 8 Q.No. 9 or 10, Q.No. 11 or 12,*
  - (2) *Answers to the two sections should be written in separate answer-books.*
  - (3) *Figures to the right indicate full marks.*
  - (4) *Use of non-programmable pocket size scientific calculator is permitted.*
  - (5) *Neat diagrams must be drawn whenever necessary.*
  - (6) *Assume suitable data, if necessary.*
- 
- 

**Section I**

Q. 1. (a) Derive an expression for insulation resistance of a single core cable? (08)

(b) A bucket contains 20 liters of water at 20°C. A 2.5 KW immersion heater is used to raise temperature of water to 95°C. If the overall efficiency of process is 90%, calculate the time required for the process. Find the cost of energy for 365 days if energy rate is Rs. 07 per unit. Assume Sp heat Cap. of water =4200 J/kg-k. (08)

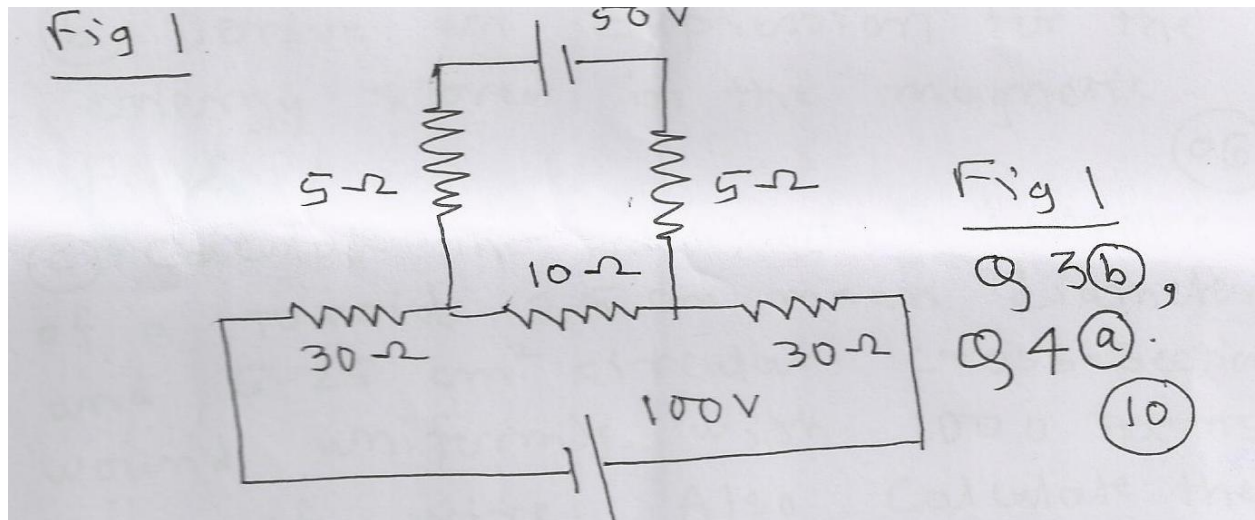
OR

Q. 2. (a) Compare Lead Acid cell and Nickel Cadmium cell. (06)

(b) A single core copper cable has a conductor diameter of 4cm and thickness of 3cm. The resistivity of copper and its insulation material is  $1.73 \times 10^{-8} \Omega\text{m}$  and  $9 \times 10^{12} \Omega\text{-m}$  respectively. Determine the resistance of conductor & insulator of the cable for the 150 meter length. (10)

Q.3. (a) State and explain. (06)  
Kirchhoff's laws as applied to simple D.C. circuit.

(b) Determine the current delivered by 50V source of 100V source for (10)  
circuit shown in Fig. 1



Q.4. (a) Apply Superposition theorem, to calculate current flowing in  $10\Omega$  resistance for the circuit shown in Fig. 1. (10)

(b) Derive formulae to convert Delta connected network into its star connected equivalent network. (6)

Q.5. (a) Compare Electric & Magnetic circuits. (8)

(b) A coil of 200 turns is wound uniformly over a magnetic ring of 80cm (10)  
mean circumference and cross sectional area of  $0.6 \text{ cm}^2$ . If the current through the coil is 2Amp, calculate i) magnetizing Force ii) reluctance iii) Flux and iv) Flux density.

Q.6. (a) State and explain faraday's laws of Electromagnetic induction. (06)

(b) Derive an expression for the energy stored in the magnetic Field. (06)

(c) Calculate the inductance of a toroid 25cm mean diameter and 6.25 (06)  
circular cross-section wound uniformly with 1000 turns wire. Also calculate the  
emf induced when a current increasing at the rate of 200A/s flows in the winding.

### Section- II

Q7. (a) Define average value of alternating quantity. Derive the expression for  
average value of a sinusoidally varying current. (08)

(b) A sinusoidal voltage of 50Hz has a maximum value of 282.84V. At what  
time from the positive zero crossing will the instantaneous voltage be equal to  
+141.4 and -141.4V (08)

**OR**

Q8. (a) Define the terms.

(i) Electric Flux (ii) Electric Flux density (iii) Electric Field strength and  
(iv) permittivity. (08)

(b) Define rms value of an alternating quantity. Derive an expression for rms  
value of a sinusoidally varying current. (08)

Q9. (a) Prove that current in purely capacitive leads the applied voltage (10)  
by  $90^\circ$  and current in purely inductive circuit lags the applied voltage by  $90^\circ$

(b) A series R-C circuit consisting of resistance of 50 ohms and capacitor of  
100 $\mu$ F is connected across 230V, 50 Hz supply. Calculate voltage across Resistance  
& capacitance, power factor & power consumed. (08)

**OR**

Q10. (a) Define i) admittance, ii) conductance and iii) susceptance and draw the  
admittance triangle. (08)

(b) The two impedance  $(8+j6)$  ohm and  $(3-4j)$  ohm are connected in parallel. If the total current draw is 25 Amps, calculate the current & power taken by impedance. (10)

Q11. (a) Write short note on (10)

i) Losses taking place in transformer and

ii) An auto transformer.

(b) Define i) Phase Sequence, ii) symmetrical supply and  
iii) Balanced load. (06)

OR

Q12. (a) Derive expression for emf induced in a transformer. (06)

(b) Three coils, each having a resistance of  $8\Omega$  and an inductance of  $0.02H$ , are connected in delta across a three Phase, 400V, 50Hz supply. Calculate power consumed by load. If same coil are connected in star across same supply, Calculate power consumed. (10)

Total No. of Questions: 06

Total No of Printed Pages: 05

F.E (Common), Examination: June - 2013

Engineering Mechanics 2008 course

[4361]-10

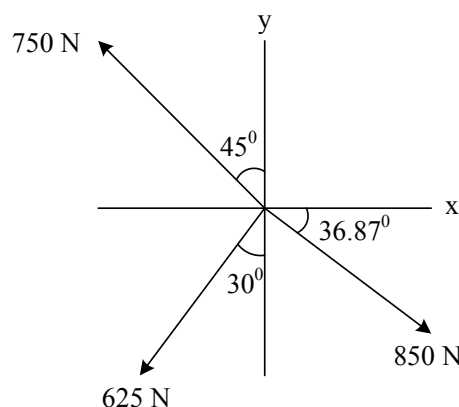
Time: 02 Hours

Max. Marks: 50

**Instructions:**

1. Attempt Q. 1 or Q. 2, Q. 3 or Q. 4 and Q. 5 or Q. 6.
2. Answer should be written in one answer book.
2. Neat diagram must be drawn wherever necessary.
3. Figure to the right indicates full marks.
4. Assume suitable data, if necessary and clearly state.
5. Use of cell phone is prohibited in the examination hall.
6. Use of electronic pocket calculator is allowed.

**Q. 1 a)** Determine the magnitude of the resultant force and its direction, measured counterclockwise from the positive x-axis as shown in Fig. 1 a. **(06)**



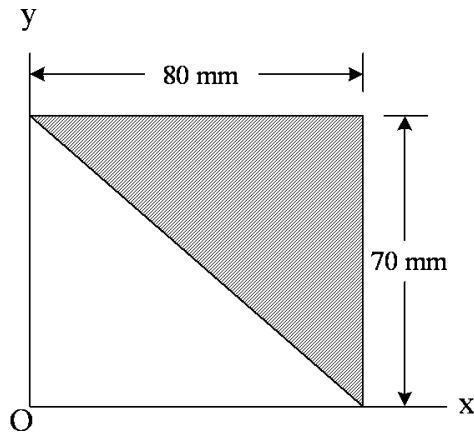
**Fig. 1 a**

- b)** A bicyclist starts from rest and after traveling along a straight path a distance of 20 m reaches a speed of 30 kmph. Determine the constant acceleration and how long does it take to reach the speed of 30 km/h. **(06)**

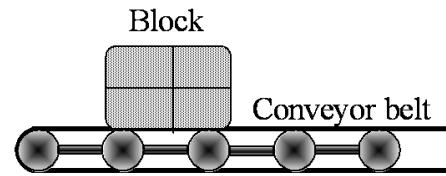
**OR**

**Q. 2 a)** Determine the position of centroid of the shaded area as shown in Fig. 2 a with respect to origin O. **(06)**

- b) The conveyor belt is designed to transport packages of various weights. Each 50 kg package has a coefficient of kinetic friction  $\mu_k = 0.20$ . If the speed of the conveyor is 25 m/s, and then it suddenly stop, determine the distance the package will slide on the belt before coming to rest. Refer **Fig. 2 b**. (06)

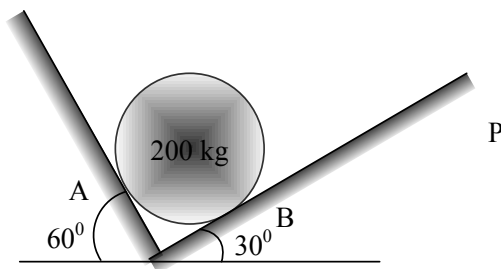


**Fig. 2 a**

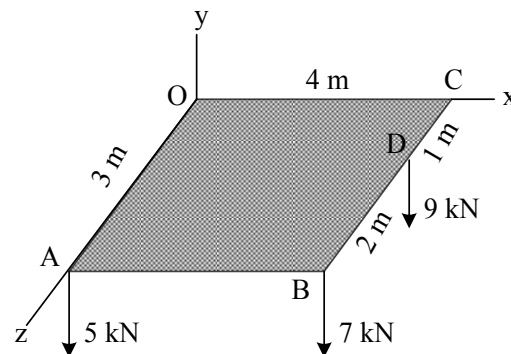


**Fig. 2 b**

- Q. 3 a) Spheres A having mass 200 kg held in equilibrium as shown in **Fig. 3 a**. Determine the normal reactions at the point of contact. (06)
- b) Three forces are acting on a plate of as shown in **Fig. 3 b**. Find magnitude and point of application of resultant force on the plate. (07)



**Fig. 3 a**



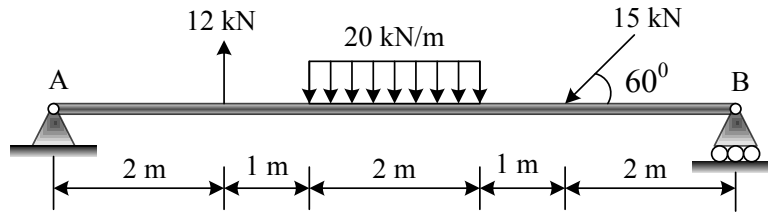
**Fig. 3 b**

- c) A particle position is describe by the coordinates  $r = (2\sin 2\theta)$  m (06)  
and  $\theta = (4t)$  rad, where  $t$  is in seconds. Determine the radial and transverse components of its velocity when  $t = 1$  s.

**OR**

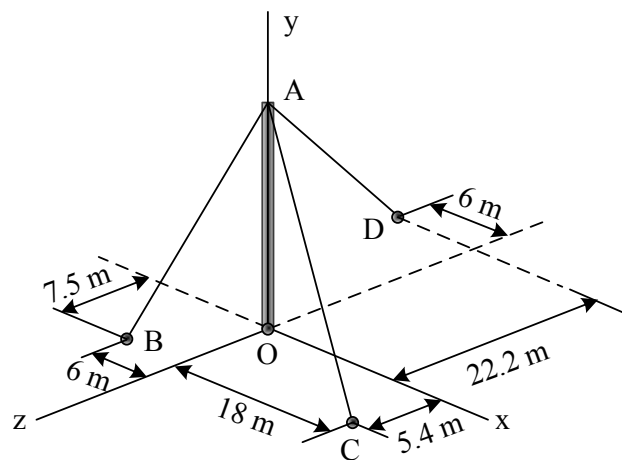
- Q. 4 a) Determine the support reaction for the beam loaded and supported as shown in **Fig. 4 a**. (06)





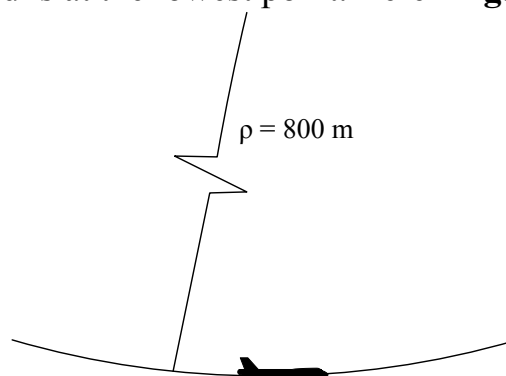
**Fig. 4 a**

- b) An electric pole OA of height 30 m is held by three ropes to a pin at A and anchored at B, C and D as shown in **Fig. 4 b**. If the tension in rope AC is 2.6 kN, determine the vertical force P exerted by the pole on the pin at A. (07)



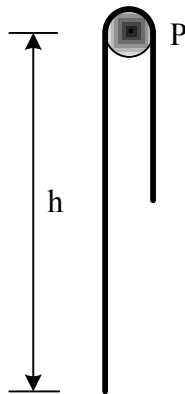
**Fig. 4 b**

- c) Determine the maximum constant speed at which the pilot can travel around the vertical curve having a radius of curvature  $\rho = 800$  m, so that he experiences a maximum acceleration  $a_n = 8g = 78.5 \text{ m/s}^2$ . If he has a mass of 70 kg, determine the normal force he exerts on the seat of the airplane when the plane is traveling at this speed and is at the lowest point. Refer **Fig. 4 c**. (06)

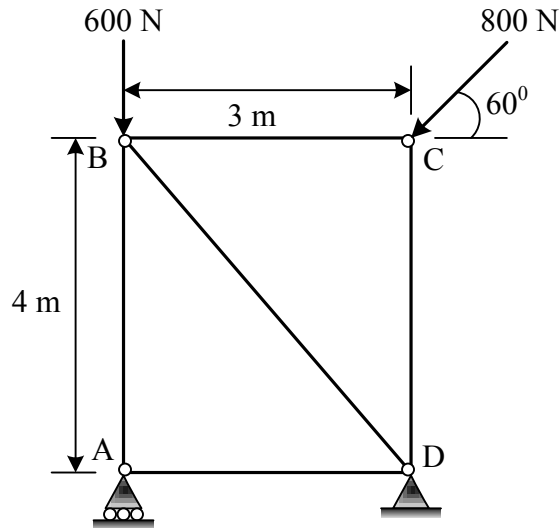


**Fig. 4 c**

- Q. 5 a)** The locomotive of a train exerts a constant pull of 400 kN on the cars, which have a total mass of  $2 \times 10^6$  kg. The cars have a total frictional resistance of 6.5 kN and are originally traveling at 2 m/s up a slope of  $1^\circ$ . Determine the speed of the cars after they travel 2 km. (06)
- b)** A cord having a weight of 0.5 N/m and a total length of 10 m is suspended over a peg P as shown in **Fig. 5 b**. If the coefficient of static friction between the peg and cord is 0.5, determine the longest length  $h$  which one side of the suspended cord can have without causing motion. Neglect the size of peg and length of cord draped over it. (06)
- c)** Determine the force in each member of the truss and state the members are in tension or compression. Refer **Fig. 5 c**. (07)



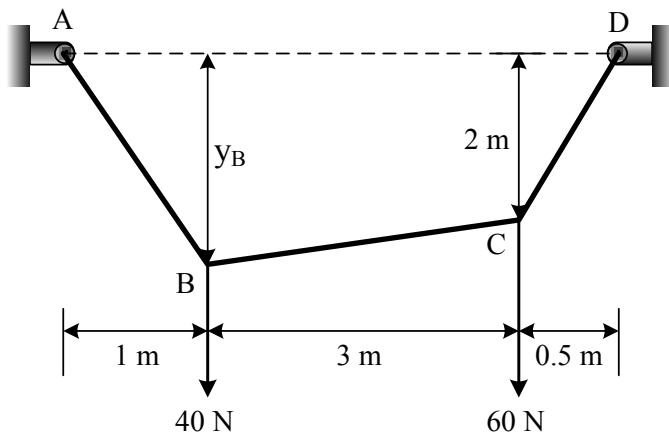
**Fig. 5 b**



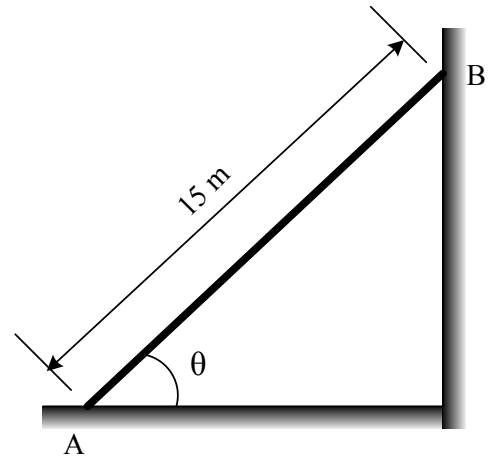
**Fig. 5 c**

**OR**

- Q. 6 a)** Cable ABCD supports two point load at point B and C as shown in **Fig. 6 a**. Determine the maximum tension in the cable segment and the sag of point B. (07)
- b)** Determine the smallest angle  $\theta$  at which the ladder shown in **Fig. 6 b** can be placed against the side of smooth wall without having it slip. (06)
- c)** A jet plane has a mass of 250 Mg and a horizontal velocity of 100 m/s when  $t = 0$ . If the engines provide a resultant horizontal thrust  $F = (200 + 2t^2)$  kN, where  $t$  is in seconds. Determine the plane's velocity in  $t = 5$  s. Neglect air resistance and the loss of fuel during the motion. (06)



**Fig. 6 a**



**Fig. 6 b**

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**UNIVERSITY OF PUNE**  
**[4361]-12**  
**F. E.(Common)Examination - 2013**  
**BASIC ELECTRONICS ENGINEERING**  
**(2008 Pattern)**

**[Total No. of Questions: 6]**  
**[Time : 2 Hours]**

**[Total No. of Printed Pages :3]**  
**[Max. Marks : 50]**

- (1) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6 .*
- (2) Answers all questions in same answer-book.*
- (3) Black figures to the right indicate full marks.*
- (4) Neat diagrams must be drawn wherever necessary.*
- (5) Use of electronics pocket calculator is allowed.*
- (6) Assume suitable data, if necessary.*

Q1 a) A bridge rectifier is applied with input from a step down transformer [8]

having turns ratio 8:1 and input 230V, 50Hz. If  $R_f = 1\Omega$ ,  $R_s = 10\Omega$  and

$R_L = 2\text{ K}\Omega$ . Find: I. DC power output II. PIV across each diode

III. Percentage efficiency IV. Percentage regulation at full load.

b) Explain how transistor can be used as an amplifier with the help of [6]  
load line approach.

c) State the various methods of turning on SCR. [4]

**OR**

Q2 a) With the help of neat circuit diagram, explain how will you use the [8]

Zener diode as a voltage regulator. What is maximum and minimum limit  
for the load current?

b) Sketch JFET drain and transfer characteristics and indicate following [6]

parameters: I. Pinch off voltage      II. Drain self saturating current

III.  $V_{GS(OFF)}$       IV. Region of operation

c) Draw and explain V-I characteristics of Triac. [4]

Q3 a) Draw a neat diagram of three-input inverting summing amplifier using [8]

op-amp and obtain the expression of its output voltage.

b) Realize three-input gate using two-input gates for the following gate: [8]

I. AND      II. OR      III. NAND      IV. NOR

**OR**

Q4 a) A sinusoidal signal with peak value 6mV with 2kHz frequency is [8]

applied to the input of ideal op-amp integrator with  $R_1 = 100 \text{ k}\Omega$  and

$C_f = 1 \mu \text{ F}$ .

Find the output voltage.

b) Prove the following using DeMorgan's theorem. [8]

1)  $AB + CD = \overline{(\overline{A} \overline{B}) \cdot (\overline{C} \overline{D})}$

2)  $(A+B)(C+D) = \overline{(\overline{A} \overline{B}) + (\overline{C} \overline{D})}$

Q5 a) Explain the following characteristics of transducer: [4]

I. Accuracy      II. Ruggedness      III. Linearity      IV. Repeatability

b) Explain the principal of operation of Strain Gauge. [4]

c) Explain Super-heterodyne receiver with the help of block diagram. [8]

**OR**

- Q6    a) What is RTD? Draw its constructional diagram and explain its operation. [8]
- b) Explain wired communication and wireless communication. [4]
- c) Explain problem with pair cables. State different types of twisted pair cable. [4]

**UNIVERSITY OF PUNE**  
**[4361-1]**  
**F.E.-Maths-I**  
**Engineering Mathematics -I**  
**(2008 pattern)**

**Time-Three hours**

**Maximum Marks-100**

**[Total No. of Question=12]**

**[Total no. of printed pages= 5]**

**Instructions:**

- (1) Answer 3 questions from Section-I and 3 questions from Section-II.
- (2) Answers to the two sections should be written in separate answer books.
- (3) Neat diagrams must be drawn whenever necessary.
- (4) Figures to the right indicate full marks.
- (5) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

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**SECTION-I**

Q.1 (a) Reduce matrix  $A = \begin{bmatrix} 1 & 2 & -1 & 2 \\ -2 & 5 & 3 & 0 \\ 1 & 0 & 1 & 10 \end{bmatrix}$  to its Normal form and Hence determine its RANK. (5)

(b) Determine the values of 'k' for which the system of equations,

$$x + y + z = 1$$

$$x + 2y + 4z = k$$

$x + 4y + 10z = k^2$  is consistent. Find the solution for  $k=1$ . (6)



(c) Verify Cayley-Hamilton's theorem for the matrix  $A = \begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$  and hence find matrix for  $A^4 - 5A^3 + 8A^2$ . (6)

OR

Q.2 (a) Find eigen values and eigen vectors for  $A = \begin{bmatrix} 4 & 2 & -2 \\ -5 & 3 & 2 \\ -2 & 4 & 1 \end{bmatrix}$ . (6)

(b) Examine the vectors. (6)

$$X_1 = (1, 2, 3, -2), X_2 = (2, -2, 1, 3), X_3 = (3, 0, 4, 1)$$

For Linear dependence or independence.

(c) Is the matrix  $A = \frac{1}{3} \begin{bmatrix} 2 & 2 & 1 \\ -2 & 1 & 2 \\ 1 & -2 & 2 \end{bmatrix}$  orthogonal? If not, can it be converted to orthogonal? (5)

Q.3 (a) Show that  $(1 + \sqrt[3]{3})^8 + (1 - \sqrt[3]{3})^8 = -2^8$ . (5)

(b) If  $|i + z| = |i - z|$  then show that  $z$  is a real quantity. (5)

(c) If  $\operatorname{cosec}\left(\frac{\pi}{4} + ix\right) = u + iv$ , where  $u, v, x$  are real then show that  $(u^2 + v^2)^2 = 2(u^2 - v^2)$  (6)

OR

Q.4 (a) If  $i^{\alpha + i\beta} = \alpha + i\beta$ , then show that  $\alpha^2 + \beta^2 = e^{-(4m+1)\pi\beta}$ . (5)

(b) Solve by using De-Moivre's theorem  $z^3 = i(z-1)^3$ . (5)

(c) If  $z_1, z_2$  and origin '0' represent on the Argand's diagram, vertices of an equilateral triangle then show that (6)

$$\frac{1}{z_1^2} + \frac{1}{z_2^2} = \frac{1}{z_1 z_2}$$

Q.5 (a) If  $y = \cosh 4x \cos 3x$ , then find  $y_n$ . (6)

(b) If  $x = \sin \theta$ ,  $y = \sin 2\theta$  then prove that  $(1 - x^2)y_{n+2} - (2n+1)xy_{n+1} - (n^2 - 4)y_n = 0$  (6)

(c) Discuss convergence or divergence (any one). (5)

(i)  $\sum_{n=1}^{\infty} \frac{(n+1)^n}{n!}$

(ii)  $\sum_{n=r}^{\infty} \sqrt{n^3+1} - \sqrt{n^3}$

Q.6 (a) If  $f(x) = \tan x$  then show that (6)

$$f^n(0) - n_{c_2} f^{n-2}(0) + u C_4 f^{n-4}(0) \dots = \sin\left(\frac{n\pi}{2}\right)$$

(b) If  $y = \frac{x^4}{(x-1)(x-2)}$ , then find  $y_n$ . (6)

(c) Discuss convergence or divergence (any one) (5)

(i)  $\frac{1}{2\sqrt{1}} + \frac{x^2}{3\sqrt{2}} + \frac{x^4}{4\sqrt{3}} + \dots$

(ii)  $\sum_{n=1}^{\infty} \frac{5^n + a}{3^n + b} \quad (a > 0, b > 0)$

## SECTION-II

Q.7 (a) Expand  $(1+x)^x$  in the power of  $x$  up to  $x^5$ . (6)

(b) Expand  $x^4 - 3x^3 + 2x^2 - x + 1$  in the powers of ' $x-3$ '. (5)

(c) Attempt any one. (6)

(i) Find the constant  $a, b$  so that  $\lim_{x \rightarrow 0} \frac{x(1 + a \cos x) - b \sin x}{x^3} = 1$

(ii) Evaluate  $\lim_{x \rightarrow \infty} \left[ \frac{a^{1/x} + b^{1/x} + c^{1/x}}{3} \right]^x$

OR

Q.8 (a) Show that

$$\tan^{-1}\left\{\frac{p-qx}{q+px}\right\} = \tan^{-1}\left(\frac{p}{q}\right) - \left\{x - \frac{x^3}{3} + \frac{x^5}{5} - + - \dots\right\} \quad (6)$$

(b) Expand  $\log \cos x$  in the powers of  $x - \frac{\pi}{3}$ , by using Taylor's series. (5)

(c) Attempt any one. (6)

(i) Evaluate :  $\lim_{x \rightarrow 0} \frac{\cot x - \frac{1}{x}}{x}$

(ii) Evaluate:  $\lim_{x \rightarrow 0} \left[ \frac{\pi}{4x} - \frac{\pi}{2x(e^{\pi x} + 1)} \right]$

Q.9 Attempt any two.

(a) If  $u=f(r)$ , where  $x=r \cos \theta, y=r \sin \theta$  then show that

$$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = f''(r) + \frac{1}{r} f'(r) \quad (8)$$

(b) If  $u = \operatorname{cosec}^{-1} \sqrt{\frac{x^{1/2} + y^{1/2}}{x^{1/3} + y^{1/3}}}$  then

show that  $x^2 u_{xx} + 2xy u_{xy} + y^2 u_{yy} = \frac{\tan u}{12} \left\{ \frac{13}{12} + \frac{\tan^2 u}{12} \right\}$  (8)

(c) If  $z=f(x,y)$ , where  $x=e^u \cos v, y=e^u \sin v$ , then show that  $y \frac{\partial z}{\partial u} + x \frac{\partial z}{\partial v} = e^2 u \frac{\partial z}{\partial y}$  (8)

**OR**

Q.10 (a) If  $u = \frac{(x^2 + y^2)^m}{2m(2m-1)} + x f\left(\frac{y}{x}\right) + \phi\left(\frac{y}{x}\right)$  then find  $x^2 u_{xx} + 2xy u_{xy} + y^2 u_{yy}$  (8)

(b) If  $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$  and  $lx + my + nz = 0$  then find  $\frac{dy}{dx}$  and  $\frac{dy}{dz}$  (8)

(c) If  $u = x^y + y^x$  then show that  $\frac{\partial^2 u}{\partial x \partial y} = \frac{\partial^2 u}{\partial y \partial x}$  (8)

Q.11 (a) Show that the functions  $u=x+y+z, v=x^2+y^2+z^2, w=xy+yz+zx$  are

functionally dependent .Hence ,find the relation between u,v and w. (6)

(b)Use Langrange's Methods to find minimum distance from origin to find plane  $3x + 2y + z = 12$ . (6)

(c)The resonant frequency in a series electrical circuit is given by  $f = \frac{1}{2\pi\sqrt{LC}}$  .If measurement of L and C are in error by 2 % and -1 % respectively.find Percentage error in calculated value of f. (5)

**OR**

Q.12 (a)If  $x = e^u \cos v$ ,  $y = e^u \sin v$  then show that  $JJ' = 1$ . (6)

(b)Determine maximum or minimum values of  $x^3 y^2 (1 - x - y)$  . (6)

(c)If  $x = u + v$ ,  $y = v^2 + w^2$ ,  $z = w^3 + u^3$  find  $\frac{\partial u}{\partial x}$  . (5)

**UNIVERSITY OF PUNE**  
**[4361]-5**  
**F. E. (May / June 2013 Examination)**  
**Basic Civil and Environmental Engineering**  
**(2008 Course)**

**[Total No. of Questions:12]**  
**[Time : 3 Hours]**

**[Total No. Printed Pages: 4]**  
**[Max. Marks:100]**

**SECTION -I**

- Q.1 a) Explain in brief the role of Civil engineer in Infrastructure development of any country. [4]
- b) State Comparison between Highways and Railways. [6]
- c) State various practical applications of Geotechnical engineering and foundation engineering [6]

**OR**

- Q.2 a) Explain with a neat sketch the Working principle of remote sensing. [4]
- b) Define the term Gauge and Draw a neat sketch of Railway Track. [6]
- c) Explain in brief the merits and demerits of any major Irrigation project [6]

- Q.3 a) How will you check the quality of bricks and cement at construction site. [6]
- b) What is the Importance of Sand in construction. State any four advantages of artificial Sand. [4]
- c) Define foundation Settlement. Also state various causes of it. [6]

**OR**

- Q.4 a) Explain in brief the need of Automation in construction Industry. [4]

b) State Comparison between Framed Structure and Load Bearing Structure. [6]

c) Draw a neat sketch of the following : [6]

1) Pile foundation

2) Combined Footing

Q.5 a) What is Map? State various types of Map. Explain any one in brief. [5]

b) What is GPS? Explain in brief the various components of GPS [5]

c) Write a short note on Digital Planimeter [4]

d) Define the following terms used in levelling [4]

1) Reduced Level 2) Change point 3) Level Line

4) Height of instrument.

**OR**

Q.6 a) Define Surveying. state fundamental principles of surveying. [5]

Explain any one in brief.

b) What is Total station. State any four use of Total station. [3]

c) Write in detail the Stepwise procedure of levelling of dumpy level [4]

d) The following consecutive readings were taken with a dumpy [6]

level and 4 m levelling staff, 0.760, 0.900, 1.430, 1.750, 0.500,  
1.750, 1.525, 0.850, 1.800.

The level was shifted after 4<sup>th</sup> and 7<sup>th</sup> reading. The first reading taken on a B.M of R.L. 100.00 m calculate the Reduced Levels of all stations by using collimation plane method. Apply usual arithmetic check.

## SECTION -II

- Q.7 a) Enlist any four natural resources. Explain in brief the necessity of conserving natural resources. [4]
- b) Explain in brief the Biotic and A Biotic components of ecosystem [4]
- c) Write a short note no: [8]
- 1) Carbon Cycle
  - 2) E- waste

**OR**

- Q.8 a) What is EIA. State various methods of carrying out EIA. Explain any one in brief. [4]
- b) What do you mean by sustainable development. What techniques/ methods are used to achieve it. [4]
- c) Write a short note on: [8]
- 1) Solid waste management
  - 2) Hydrological Cycle
- Q.9 a) Explain in brief the necessity of building bye-laws. [4]
- b) Explain with a neat sketch the following: [4]
- 1) Circulation
  - 2) Elegance
- c) A owner wants to constructs a three storeyed building on a plot of size 30 m x 30 m. The Built up area on Ground floor is 400 m<sup>2</sup> and First floor is 350 m<sup>2</sup>. How much area can be construct on second floor if the permissible FSI is 1.2 [4]
- d) Write a short note on use of Ecofriendly materials in construction. [4]



Q.10 a) Distinguish between Aspect and Prospect [4]

b) Write a short note on Green Building. [4]

c) Determine the carpet area per floor of a two storeyed building [4]

from the following data :

1) Plot Area =  $1200 \text{ m}^2$

2) F.S.I. allowed = 1.0

3) Ratio of carpet area to built up area = 0.75 Assume equal built up area on each floor.

d) Write note on set back distance. [4]

Q.11 a) Write short notes of following : [18]

1) Land Pollution

2) Green House Effect

3) Primary and secondary air Pollutants

4) Water Pollution

**OR**

Q.12 a) Write short notes on following : [18]

1) Global warming

2) Conventional Sources of energy

3) Wind Energy

4) Solar Energy

**UNIVERSITY OF PUNE**

**[4361-7]**

**F.E. Examination 2013**

**Engineering Mathematics -II**

**(2008 pattern)**

**Time-Three hours**

**Maximum Marks-100**

**[Total No. of Question=12]**

**[Total no. of printed pages= 5]**

**Instructions:**

- (1) In Section -I Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6. In Section-II Solve Q.7 or Q.8, Q.9 or Q.10, Q.11 or Q.12
- (2) Neat diagrams must be drawn wherever necessary.
- (3) Figures to the right indicate full marks.
- (4) Use of electronic pocket calculator is allowed.
- (5) Assume suitable data wherever necessary.

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**SECTION-I**

Q.1 (a) Form the differential equation whose general solution is

$$(X-A)^2 + (Y-B)^2 = 16 \quad \text{where A and B are arbitrary constants.} \quad (6)$$

(b) Solve **any two**. (10)

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

(ii)  $\frac{dy}{dx} = \frac{x+y+1}{2x+2y+3}$

(iii)  $\frac{dy}{dx} + y \cot x = \sin 2x$

**OR**

Q.2 (a) By eliminating arbitrary constants a & b find the differential equation whose general solution is  $y = \log \cos(x-a) + b$ . (6)

(b) Solve any two. (10)

(i)  $\frac{dy}{dx} = e^{x-y} (e^x - e^y)$

(ii)  $\frac{dy}{dx} = \frac{\tan y - 2xy - y}{x^2 - x \tan^2 y + \sec^2 y}$

(iii)  $(y^4 - 2x^3 y) dx + (x^4 - 2xy^3) dy = 0$

Q.3 Solve any three. (18)

(a) If the temperature of the body drops from  $100^\circ C$  to  $60^\circ C$  in one minute, the temperature of surrounding being  $20^\circ C$ , what will be the temperature of the body after two minutes?

(b) In a circuit containing inductance  $L$ , resistance  $R$  and voltage  $E$ , the current  $I$  is given by  $E = RI + L \frac{dI}{dt}$ . Given  $L = 320H$ ,  $R = 125\Omega$  and  $E = 250$  volts,  $I$  being zero when  $t = 0$ . Find the time that elapses before current reaches half of its theoretical maximum.

(c) A particle is moving in a straight line with an acceleration  $k \left[ x + \frac{a^4}{x^4} \right]$ , directed towards origin. If it starts from rest at a distance 'a' from origin, prove that it will arrive at origin at the end of time  $\frac{\pi}{4\sqrt{k}}$ .

(d) Find orthogonal trajectories of the family of curves given by  $x^2 + 2y^2 = c^2$  where  $c$  is arbitrary constant.

OR

Q.4 Solve any three. (18)

(a) A pipe 10 cm in diameter contains steam at  $200^\circ C$ . It is protected with a covering 5 cm thick, for which  $k = 0.12$  and outside surface is at  $50^\circ C$ . Find the temperature half way through the covering under steady state conditions.

(b) A body of mass  $m$  falls from rest under the influence of gravity and a retarding force, due to air resistance, proportional to instantaneous velocity of the body. Find velocity and distance described as a function of time.

(c) The charge ' $Q$ ' on the plate of a condenser of capacity ' $C$ ' charged through a resistance ' $R$ ' by a steady voltage ' $V$ ' satisfies the differential equation.

$R \frac{dQ}{dt} + \frac{Q}{C} = V$ . If  $Q=0$  at  $t=0$ , show that  $Q = CV[1 - e^{-t/RC}]$ . Find the current flowing into the circuit.

(d) The amount  $x$  of a substance in a certain chemical reaction at time  $t$  is given by

$$\frac{dx}{dt} + \frac{x}{10} = 2 - 1.5e^{-t/10}. \text{ If at } t=0, x=0.5, \text{ find } x \text{ at } t=10.$$

Q.5 (a) Find the Fourier series to represent the function  $f(x) = x^2$ , in the interval  $-\pi < x < \pi$  and  $f(x + 2\pi) = f(x)$  for all  $x$ .

Deduce that  $\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \dots = \frac{\pi^2}{6}$ . (9)

(b) If  $I_n = \int_0^{\frac{\pi}{4}} \cos^{2n} x \, dx$ , prove that  $I_n = \frac{1}{n2^{n-1}} + \frac{2n-1}{2n} I_{n-1}$

Hence evaluate  $\int_0^{\frac{\pi}{4}} \cos^6 x \, dx$ . (7)

OR

Q.6 (a) Find the Fourier series upto first harmonics to represent  $f(x)$  in the interval  $(0, 2\pi)$  from the tabulated values of  $x$  &  $f(x)$  given below. (8)

$x$	0	$\frac{\pi}{3}$	$\frac{2\pi}{3}$	$\pi$	$\frac{4\pi}{3}$	$\frac{5\pi}{3}$	$2\pi$
$f(x)$	1.0	1.4	1.9	1.7	1.5	1.2	1.0

(b) Evaluate ;  $\int_0^{\infty} \sqrt{x} e^{-\sqrt{x}} \, dx$ . (4)

$$(c) \int_3^7 (x-3)^{1/4} (7-x)^{1/4} dx \quad (4)$$

## SECTION-II

Q.7 (a) Trace the following curves. (any two). (8)

(i)  $3ay^2 = x(x-a)^2$

(ii)  $r = a(1 + \cos \theta)$

(iii)  $x = t^2, y = t - \frac{t^3}{3}$

(b) Using DUIS evaluate. (5)

$$\int_0^{\infty} \frac{e^{-x}}{x} \left( a - \frac{1}{x} + \frac{1}{x} e^{-ax} \right) dx$$

(c) Using proper rectification formula, find the circumference of the circle of radius  $a$ . (4)

OR

Q.8 (a) Trace the following curves (any two). (8)

(i)  $a^2 y^2 = x^2 (2a-x)(x-a)$

(ii)  $x = a(t + \sin t), y = a(1 - \cos t)$

(iii)  $r = a + b \cos \theta$  for  $a > b$

(b) Show that  $\int_0^{\infty} e^{-(x+a)^2} dx = \frac{\sqrt{\pi}}{2} [1 - \operatorname{erf}(a)]$  (4)

(c) Find the whole length of the loop of the curve  $9y^2 = (x+7)(x+4)^2$  (5)

Q.9 (a) A sphere of constant radius  $r$  passes through the origin and cuts the axes in the points A, B, C. Find the locus of the foot of perpendicular from origin to the plane ABC. (6)

(b) Find the equation of the right circular cone with vertex at  $(1, 2, -3)$ , semivertical angle  $\cos^{-1}(\frac{1}{\sqrt{3}})$  and axis is the line  $\frac{x-1}{1} = \frac{y-2}{2} = \frac{z+3}{-1}$  (6)

(c) Find the equation of the right circular cylinder of radius 2, whose axis is the line  $\frac{x-1}{2} = \frac{y-2}{1} = \frac{z-3}{2}$ . (5)

OR

Q.10 (a) Find the equations of tangent planes to the sphere  $x^2 + y^2 + z^2 = 9$  which pass through the line  $x + y = 6, x - 2z = 3$ . (6)

(b) Find the equation of right circular cone which has its vertex at the point  $(0, 0, 10)$  and whose intersection with the  $xy$  plane is circle of diameter 10. (6)

(c) Find the equation of right circular cylinder of radius 2 whose axis pass through  $(1, 2, 3)$  and has direction cosines proportional to  $2, -3, 6$ . (5)

Q.11 Solve any two. (8)

(a) Evaluate  $\int \int_R \sqrt{xy(1-x-y)} dx dy$  where  $R$  is the area bounded by  $x=0, y=0$  and  $x+y=1$ . (8)

(b) Change the order of integration in double integral. (8)

$$\int_0^a \int_{\sqrt{a^2-y^2}}^{y+a} f(x, y) dx dy$$

(c) Find the area common to the circles. (8)

$$x^2 + y^2 = a^2 \quad \text{And} \quad x^2 + y^2 = 2ax$$

OR

Q.12 Solve any two.

(a) Express the following as a single term integral and evaluate: (8)

$$\int_0^{\frac{a}{\sqrt{2}}} \int_0^x \cos k(x^2 + y^2) dx dy + \int_{\frac{a}{\sqrt{2}}}^a \int_0^{\sqrt{a^2-x^2}} \cos k(x^2 + y^2) dx dy$$

(b) Evaluate  $\int_0^\infty \int_0^\infty \int_0^\infty \frac{dx dy dz}{(1 + x^2 + y^2 + z^2)^2}$ . (8)

(c) If the density at any point of the curve  $x = a(\theta + \sin \theta), y = a(1 - \cos \theta)$  varies as its distance from the  $x$ -axis, find the distance of its C.G. of arc from the  $x$ -axis. (8)

**UNIVERSITY OF PUNE**  
**[4361]-8**  
**F. E. (APPLIED SCIENCE-II ) Examination 2013**  
**CHEMISTRY**  
**(2008 Pattern)**

**[Total No. of Questions:6]**  
**[Time : 2 Hours]**

**[Total No. of Printed pages :2]**  
**[Max. Marks : 50]**

**Instructions :**

- (1) Solve **Q.1 or Q.2, Q.3 or Q.4 and Q.5 or Q.6**
- (2) Neat diagrams must be drawn wherever necessary.
- (3) Figures to right indicate full marks.
- (4) Assume suitable data, if necessary.

- 
- Q.1. A) Define calorific value of fuel. Explain bomb calorimeter for [7]  
determination of calorific value of solid fuel with figure, working  
and formula.
- B) What is power alcohol ? Give preparation reactions, merits and [6]  
demerits of power alcohol
- C) A liquid fuel sample contains 85% C and 15% H calculate the [4]  
quantity of air with 5% excess required for complete combustion of  
2 kg of fuel

**OR**

- Q.2 A) Explain refining of petroleum with principle, diagram and process [7]  
Give the composition, boiling range and uses of any three useful fuels  
obtained.
- B) What is rocket propellant ? Explain different types of propellants with [6]  
examples.
- C) Calculate % in coal sample when 2.5 gm of coal is combusted in [4]

Bomb calorimeter. The solution from bomb pot on treatment with  $\text{BaCl}_2$  for 0.222 gm. of  $\text{BaSO}_4$  precipitate.

- Q.3 A) Explain various factors affecting the rate of corrosion of metal [6]  
B) Explain galvanising and tinning methods for metal coating with figure [6] and process  
C) Explain reaction and nature of oxide film for atmospheric corrosion of [4] Mg and Ag.

**OR**

- Q.4 A) Explain mechanism of electrochemical corrosion by hydrogen [6] evolution and oxygen absorption  
B) What is principle of cathodic protection ? Discuss the various types [6] of cathodic protection methods  
C) Write note on powder coating. [4]  
Q.5 A) Explain ion exchange method for demineralization of water with [7] figure, process, reactions and advantages.  
B) How  $\text{Cl}^-$  quantity in water is determined by Mohr's method [6]  
C) State Gibb's phase rule. Explain the terms involved in it with suitable [4] examples.

**OR**

- Q.6 A) Draw and explain sulphur system. [7]  
B) Discuss corrosion of boiler by dissolved gases and dissolved salts with [6] chemical reactions and its prevention.  
C) 50 ml of an alkaline water sample requires 4.8 ml of 0.025 N HCl [4] upto phenolphthalein end point and 13.6 ml up to methyl orange end point. Find the type and amount of alkalinity in water sample.