

**UNIVERSITY OF PUNE**  
**[4361]-102**

**F. E. (Semester - II) Examination 2013**  
**Engineering Physics**  
**(2012 Pattern)**

[Time : 2 Hours]

[Max. Marks:50]

**Instructions :**

- 1) Answer all the questions.
- 2) Black figures to the right indicate full marks.
- 3) Neat Diagram must be drawn wherever necessary.
- 4) Electronic Pocket calculator is allowed.
- 5) Assume suitable data, if necessary.

Constants :  $h = 6.63 \times 10^{-34} \text{J-s}$   
 $m_e = 9.31 \times 10^{-31} \text{kg}$   
 $e = 1.6 \times 10^{-19} \text{C}$   
 $c = 3 \times 10^8 \text{m/s}$

- Q.1 a) Explain the formation Newton's ring with diagram and drive the diameter of bright ring. [06]
- b) Discuss the use of ultrasonics for flaw Detection [03]
- c) A auditorium of volume  $5500 \text{m}^3$  is found to have reverberation time 2.5 secs. The sound absorbing surface of the auditorium has an area of  $750 \text{m}^2$ . Calculate the average absorption coefficient of the auditorium. [03]

**OR**

- Q.2 a) Define magnetostriction effect. Explain how magnetostriction oscillator is used to produce ultrasonic waves with the help of neat circuit diagram. [06]
- b) Explain with diagram how interference Principle is used to design anti reflection coating. [03]
- c) Monochromatic light from He-Ne laser source ( $\lambda = 6328 \text{Å}$ ) is incident normally on a diffraction grating having 6000 lines/cm. Find the angle at which one would observe second order maximum. [03]
- Q.3a) Define Double refraction. Explain Huygen's Theory of Double refracting crystal with diagram. [06]
- b) Define Fermi level. Plot the variation of Fermi level with the increase of temperature for n-type and p-type semiconductor. [03]

- c) Calculate the conductivity of Ge sample if the donor impurity is added to an extent of one part in  $10^8$  Ge atoms at room temperature. [03]  
(Data Given :  $N_a=6.023 \times 10^{23}$  atoms/gm-mole. At. Wt. of Ge=72.6  
Density of Ge=5.32gm/cc. , $\mu=3800 \text{ cm}^2/\text{v-s.}$ )

**OR**

- Q.4a) Define Hall effect. Derive the expression of Hall coefficient, Hall Voltage and discuss their applications. [06]  
b) Explain the process of recording Hologram with the help of LASER. [03]  
c) At what angle of incidence should a beam of sodium light be directed upon the surface of diamond crystal to produce complete polarized light (Data Given: Critical angle for diamond= $24.5^\circ$ ). [03]
- Q.5a) Derive Schrodinger time independent wave equation. [06]  
b) Define phase velocity, Group velocity and Derive their expressions. [04]  
c) Calculate the De-Broglie wavelength associated with 1 Mev proton( $m_p=1.67 \times 10^{-27}$  kg). [03]

**OR**

- Q.6a) Explain Heisenberg Uncertainty Principle and prove this principle using single slit Diffraction experiment. [06]  
b) Calculate the energy and momentum of an electron confined in a rigid box of width  $2A^0$  for lowest energy state. [04]  
c) Does the matter waves are electromagnetic waves? Explain. [03]
- Q.7 a) Explain the synthesis of nanoparticles through colloidal route with diagram . [06]  
b) Differentiate between Type-I and Type –II Superconductor with diagram [04]  
c) Explain two applications of Superconductivity. [03]

**OR**

- Q.8 a) Explain Meissner effect and Critical magnetic field for superconductivity. [06]  
b) Explain the optical and electrical properties of nanoparticles. [04]  
c) Explain the applications of nanoparticles in medical and electronic industry. [03]

**UNIVERSITY OF PUNE**  
**[4361]-103**  
**F. E. Examination - 2013**  
**ENGINEERING CHEMISTRY**  
**(2012 Pattern)**

[Time : 2 Hours]

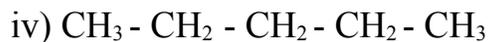
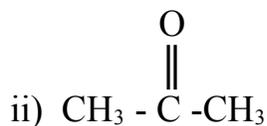
[Max. Marks : 50]

**Instructions :**

- (1) Answer **Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8**.
  - (2) Black figures to the right indicate full marks.
  - (3) Neat diagrams must be drawn wherever necessary.
  - (4) Use of logarithmic tables, slide rule, Mollier charts, electronics pocket calculator is allowed.
  - (5) Assume suitable data, if necessary.
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Q1 a) Explain boiler corrosion and caustic embrittlement as ill effects of using hard water in boilers. State their causes and preventive measures. [6]

b) Which are possible transitions, that occur when molecule absorbs uv- visible radiation? Which type of electronic transitions will be possible in following molecules. [3]



c) State the reference electrode and standard electrode used in pH metery, potentiometry and conductometry. [3]

**OR**

Q2 a) 50 ml std. hard water containing 1.2 gm  $\text{CaCO}_3$  per lit. required 15 ml EDTA solution for the end point. Whereas 50 ml sample water required 19ml of EDTA soln. and 50 ml boiled sample water required 11ml of EDTA soln. for the end point. Calculate, total, temporary and permanent hardness of sample water in ppm. [3]

b) What are the drawbacks of traditional synthesis of Indigo dye? Which is the starting substance in its green route synthesis? What are the advantages of green route synthesis over traditional? [3]

c) i) Explain effect of dilution on specific conductance and equivalent conductance. [3]

ii) Explain the titration curve for conductometric titration in case of strong acid -weak base titration. [3]

Q3 a) Define vulcanization. Explain vulcanization of natural rubber along with Chemical reaction involved. Compare natural rubber with vulcanized rubber w.r.t. their properties. [6]

b) A gas used in internal combustion engine contain,  $H_2=45\%$ ;  $CH_4=35\%$ ;  $CO=15\%$  and  $N_2=5\%$  by volume. Find the minimum quantity (volume) of air required per  $m^3$  gas for its complete combustion. [3]

c) Define - Gross/higher calorific value and justify the relationship between GCV and NCV of the fuel, if fuel contains H % hydrogen. [3]

**OR**

Q4 a) Explain free-radical reaction mechanism for addition polymerization w.r.t monomer as vinyl chloride and initiator as acetyl peroxide. [3]

b) What are intrinsic and extrinsic polymers? Explain with their examples [3]

c) Explain knocking in petrol engine. Define octane number and explain effect of chemical structure of hydrocarbons present in petrol on knocking. [6]

Q5 a) Explain chemical storage of hydrogen in the form of metal hydrides. [5]

How sodium alanates can be used in hydrogen storage.

b) Explain preparation and structure of activated carbon and carbon black. [4]

c) What are carbon nanotubes. Explain their types in detail. [4]

**OR**

Q6

- a) Explain production of hydrogen by water splitting using solar energy. [4]
- b) Explain how saline hydrides are formed. Give preparation and application of any one saline hydride. [4]
- c) Explain the structure and applications of graphene. [5]

Q7

- a) Explain various factors affecting corrosion on the basis of nature of metal [5]
- b) Describe Anodic protection of metal for corrosion control. [4]
- c) Compare: Galvanizing and Tinning [4]

**OR**

Q8

- a) What is Powder coating? Explain any one method. [4]
- b) Explain corrosion control using proper designing and material selection method. [4]
- c) Define oxidation corrosion. Explain general mechanism of oxidation corrosion. Compare oxidation corrosion which occurs in Na metal Cu metal and Molybdenum (Mo) metal. [5]

**UNIVERSITY OF PUNE**  
**[4361]-104**  
**F. E. Examination - 2013**  
**BASIC ELECTRICAL ENGINEERING**  
**(2012 Course)**

**Total No. Of Questions: 8**                      **[Total No. Of Printed Pages: 3]**

**[Time: 2 Hours]**

**[Max. Marks: 50]**

***Instructions:***

- (1) Attempt Q. No. 1 or 2, Q. No.3 or 4, Q. No. 5 or 6, Q. 7 or 8.*
- (2) Figure to the right indicate full marks.*
- (3) Black figures to the right indicate full marks.*
- (4) Neat diagrams must be drawn wherever necessary.*
- (5) Assume suitable data, if necessary.*

Q. 1. A) What is the insulation resistance? Derive an expression for the                      (6)  
Insulation resistance of a single core cable.

B) Derive an expression for energy stored per unit volume in the magnetic                      (6)  
field.

**OR**

Q. 2.A) An iron ring has a mean circumference of 180 cm. It carries a current                      (6)  
Of 1.5 Amp and has 600 turns of coil wound over it. The relative  
Permeability of the iron is 1200. Calculate 1) MMF 2) Field strength  
and 3) flux density.

B) A piece of silver wire has a resistance of  $3\Omega$ . What will be the                      (6)  
resistance of a manganin wire one-third the length and one- third the  
diameter that of silver? The resistivity of manganin is 30 times that of  
silver.

Q.3. A) Derive an expression of R.M.S. value of an sinusoidally varying  
Current. (6)

B) Derive an expression of EMF induced in a single phase transformer (6)

**OR**

Q. 4. A) An 80KVA, 3200/400v, 50Hz, single phase transformer has 111 turns (6)

On the secondary calculate 1) No of turns on primary 2) secondary full  
load current 3) c/s area of the core if the maximum flux density is 1.2  
tesla.

B) A  $50\mu\text{F}$  capacitor is connected across a single phase 230v, 50Hz (6)

Supply. Calculate 1) the reactance offered by the capacitor 2) the  
Maximum current and 3) the rms value of the current drawn by the  
Capacitor

Q. 5. A) the voltage and current, in simple series circuit are given by (6)

$\bar{V} = 150 \angle 30^\circ$  and  $\bar{I} = 2 \angle -15^\circ$  If the supply frequency is 50Hz,  
determine, impedance, resistance, reactance and power consumed by  
the circuit.

B) Derive the relation of line & phase values of voltage and current (7)  
for three phase delta connected balanced load, with phasor .

**OR**

Q. 6. A) sketch and explain the phasor diagrams of R-L-C series CKT. (6)

When 1)  $X_L > X_C$  and 2)  $X_L < X_C$

B) Two circuits, the impedance of which are given by  $Z_1 = (10 + j15) \Omega$  and (7)

$Z_2 = (6 - j8) \Omega$  are connected in parallel across on A.C. supply. If the total

Current supplied is 15 Amp, what are the branch current drawn by two circuits.

Q. 7. A) State and explain kirchhoff's laws. (5)

B) Apply thevenin's theorem to calculate current drawn by 8 ohm (8)

Resistance for the circuit shown in fig.1

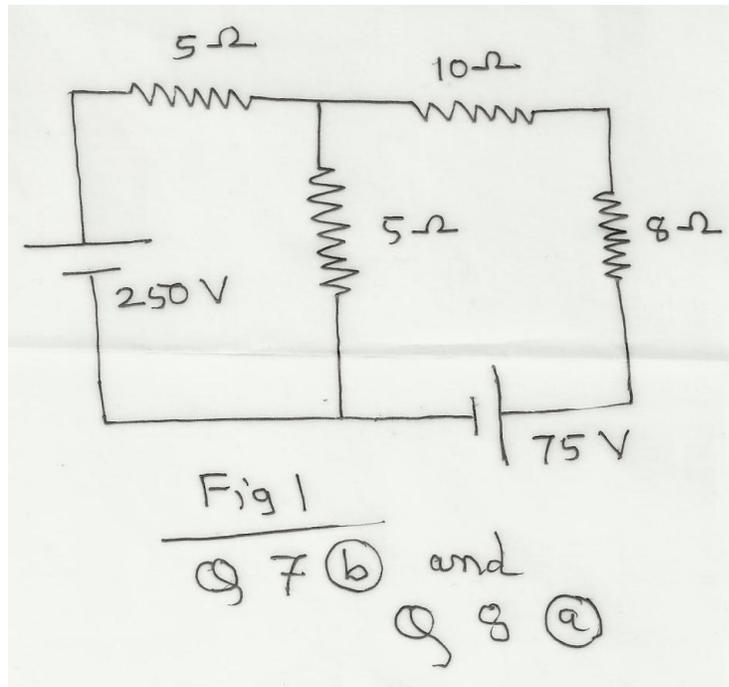


Figure 1 Q.7. B) and Q. 8. A)

**OR**

Q. 8. A) Calculate current flowing in 8 ohm resistance for the circuit shown in (8)

Fig.1 applying superposition theorem.

B) Derive formulae to convert DELTA connected network into its STAR (5)

connected equivalent network.

**UNIVERSITY OF PUNE**  
**[4361]-105**  
**F. E. Examination – 2013**  
**BASIC ELECTRONICS ENGINEERING**  
**(2012 Pattern)**

[Time : 2 Hours]

[Max. Marks : 50]

Total No. of Questions : 08

[Total No. of Printed Pages :3]

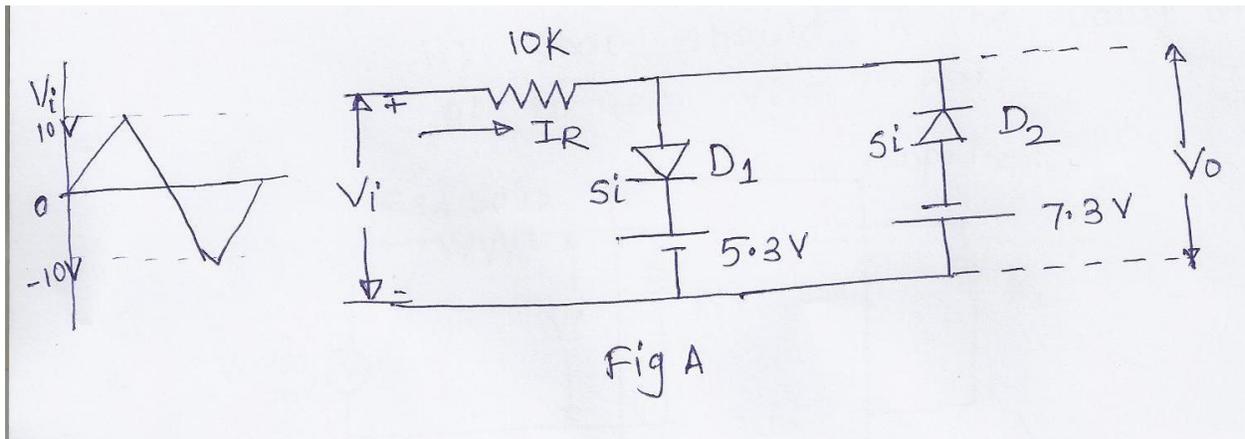
**Instructions :**

- (1) Black figures to the right indicate full marks.
- (2) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
- (3) Assume suitable data, if necessary.

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Q1) A) Sketch  $I_R$  and  $V_o$  w. r. t time for the network shown in fig. A. [06]  
Assume both the diodes are silicon type with  $V_f = 0.7$  V



B) For a BJT as a switch why CB and cc configurations are not preferred. [02]

C) Explain how  $R_i$  and  $R_o$  affect the performance of the BJT voltage amplifier. [04]

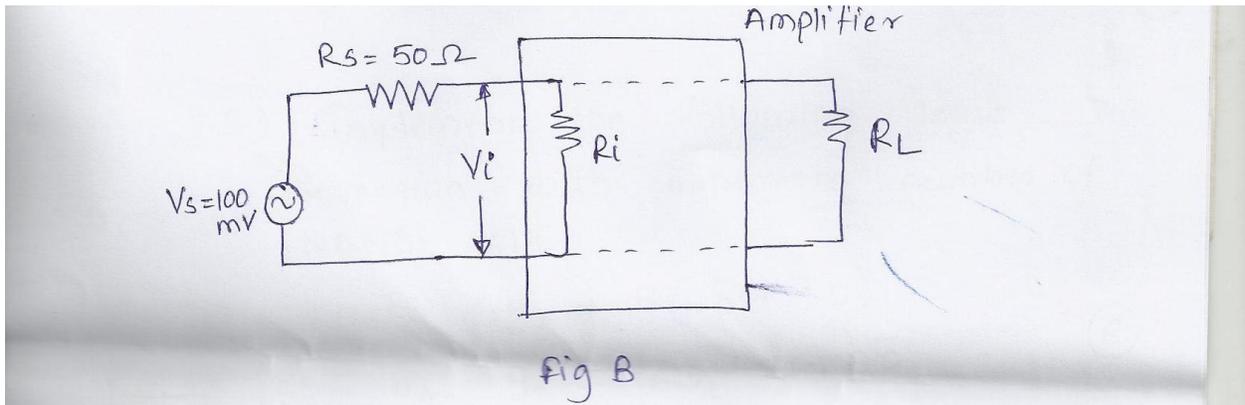
OR

Q2) A) Explain with V-I characteristics the working of zener diode as voltage regulator. [06]

B) In the voltage amplifier shown in Fig B,  $V_s = 100\text{mV}$   $R_s = 50\ \Omega$  [06]

i) Calculate input voltage  $V_i$  if the input resistance  $R_i$  is  $600\ \Omega$

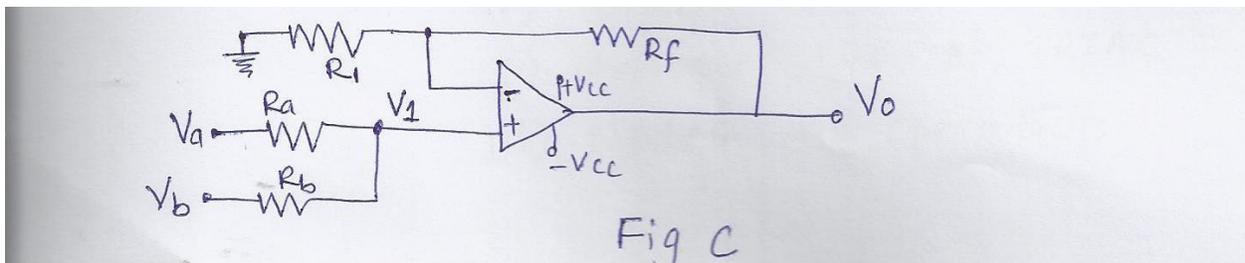
ii) What should be the value of  $R_i$  to get  $V_i = 75\text{ mV}$



Q3) A) In fig. C if  $V_a = +2\text{V}$   $V_b = +4\text{V}$  [04]

$R_a = R_b = R_1 = 1\text{ k}\ \Omega$  and  $R_f = 3\text{ k}\ \Omega$

determine the voltage  $V_1$  at non-inverting terminal of OP-AMP and output voltage  $V_o$



- B) Draw the block diagram of full adder using two half adder, explain its working with proper expression for sum and carry [06]  
C) Explain how EX-OR gate can be used as an inverter. [02]

**OR**

- Q4) A) With neat waveform explain IC555 in astable mode. [06]  
B) Implement the following logic expression with minimum number of NAND gate. [06]

i)  $y_1 = B (\bar{D} + \bar{C}D)$

ii)  $y_2 = AB + CD + B\bar{C}$

- Q5) A) Explain in detail, the selection criteria for transducer. [06]  
B) Explain in detail [07]  
i) construction of TRIAC  
ii) characteristics of TRIAC  
iii) modes of operation

**OR**

- Q6) A) Explain with block diagram an electronic weighing machine. [06]  
B) Explain the construction of DIAC w.r.t [07]  
i) Characteristics  
ii) Application

- Q7) A) What is the importance of modulation index. Draw the AM waveform for [08]  
i) Liner modulation  
ii) Over modulation  
iii) Modulation index = 0

- B) Explain the basic structure of mobile phone system. [05]

**OR**

- Q8) A) With respect to FM explain [08]  
i) Frequency deviation  
ii) Modulation index  
iii) Deviation ratio  
iv) Frequency spectrum of FM  
B) Write a note on co-axial cable and optical fibre cable. [05]

**UNIVERSITY OF PUNE**  
**[4361]-106**  
**F. E. (COMMON) Examination 2013**  
**BASIC CIVIL AND ENVIRONMENTAL ENGINEERING**  
**(2012 Course)**

**[Total No. of Questions:8]**  
**[Time : 2 Hours]**

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

**Instructions :**

- (1) Answer *Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8*
  - (2) *Neat diagrams must be drawn wherever necessary.*
  - (3) *Figures to right indicate full marks.*
  - (4) *Assume suitable data, if necessary.*
  - (5) *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
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- Q.1 a) State the general role of civil engineer in construction of a bungalow [5]  
b) Define foundation. Draw a neat labeled sketches of any two types of foundations [5]  
c) State any two practical applications of the following: [2]  
1) Irrigation engineering 2) Town planning

**OR**

- Q.2 a) State comparison between plain cement concrete and reinforced cement [5]  
b) Define steel. State various types / grades of steel and their uses in. [5]  
c) State any four practical applications of quantity surveying . [2]  
Q.3 a) Define the following terms used in leveling: [4]  
1. Bench mark 2. Line of collimation 3. Change point 4. Axis of telescope  
b) Write a short note on sustainable development [4]  
c) Explain in detail the procedure of leveling of dumpy level [4]

**OR**

Q4. a) State the various methods of collection of solid waste and explain any one in brief. [4]

b) The following staff readings were taken with a dumpy level and 4m leveling staff. The first reading was taken on BM of RL 105.535 m. The instrument was shifted after 3<sup>rd</sup> and 5<sup>th</sup> reading . Calculate the elevations of all the stations by collimation plane method. Apply usual arithmetic check and **show all the calculations**. The readings are 0.750, 1.780, 2.935, 0.425, 3.685, 0.680, 2.975 [8]

Q.5 a) Explain in brief the following principles of building planning. Also draw a neat sketch [4]

1.Circulation

2.Grouping

b) Explain in brief the necessity of building bye-laws in building construction.[4]

c) For a rectangular plot of size 25 m x 35m, permissible FSI is 1.0 and a building with G+1 storey's is to be constructed by consuming full FSI. Front margin is 3m, rear and side margins to be left is 2.5 m each. Determine the built up area of each floor. Assume width of the plot is parallel to the road [5]

**OR**

Q.6 a) Explain in brief the concept of green building [4]

b) Explain with a neat sketch, privacy as the principle of building planning [4]

c) A plot owner proposed G+1 construction with 100sq. area on each floor. [5]

The plot size is 16m x20m. Find the ground coverage and FSI proposed if all side margins are 2m each. If the FSI allowed in the area is 1.0 state with reason whether the plan will be sanctioned or not

Q.7 a) State any four merits and demerits of conventional energy sources [5]

b)Write short note on water pollution [4]

c) Enlist any four non-conventional energy sources and explain any one in brief [4]

**OR**

Q.8 a) As a responsible member of the society, what measures will you adopt to reduce the pollution caused by an automobiles [4]

b) State comparison between renewable and non-renewable energy sources [4]

c) Write a short note on green house effect [5]

**Phase III**  
**UNIVERSITY OF PUNE**  
**[4361]-107**  
**F. E. Examination - 2013**  
**ENGINEERING GRAPHICS-I**  
**(2012 Pattern)**

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

**[Total No. of Printed Pages :4]**  
**[Max. Marks : 50]**

- (1) Use only half imperial size drawing sheet as answer book.*
- (2) Retain all construction lines.*
- (3) Assume suitable data, if necessary.*

Q1 The point A of 65 mm long AB in HP and 15 mm in front of VP. The line [12]  
is inclined to HP and VP at  $40^\circ$  and  $35^\circ$  respectively. Draw the projections  
of line AB and locate its traces.

**OR**

- Q2 An equilateral triangle of 60 mm side is resting in VP on one of its side. [12]  
Then its surface is inclined to VP at an angle of  $40^\circ$ . Draw the projections of  
plane, if the resting side is inclined to HP at an angle of  $30^\circ$ . Find the  
inclination made by plane with HP.
- Q3 A square prism of base side 40 mm and axis height 60 mm is resting in [13]  
HP an one of its base corner. Then, it is tilted so that base surface is  
inclined to HP at an angle of  $30^\circ$ . Draw the projections, if the top view of the  
axis makes  $30^\circ$  with VP.

**OR**

Q4 a) Draw a cycloid of rolling circle of diameter 40 mm. [7]

b) Draw the development of lateral surface of pentagonal pyramid of base side 30mm and axis height 60 mm. [6]

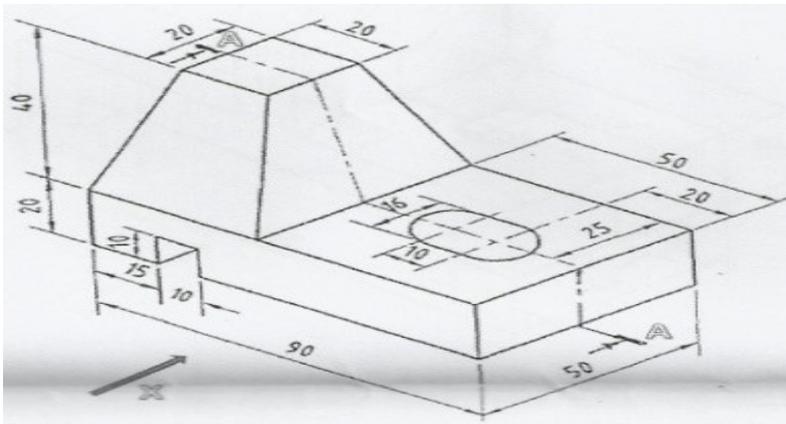
Q5 Figure 1 shows a pictorial view of an object. By using first angle method [13]  
of projections, draw:

i. Sectional front view, along given section A-A [4]

ii. Right hand side view [4]

iii. Top view [4]

iv. Dimensions [1]



**OR**

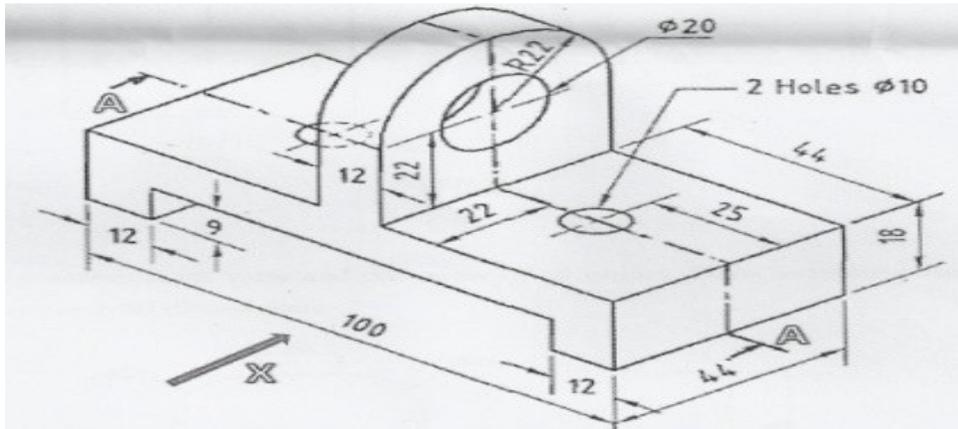
Q6 Figure 2 shows a pictorial view of an object. By using first angle method [13]  
of projections, draw;

i. Sectional front view, along sectional plane A-A [4]

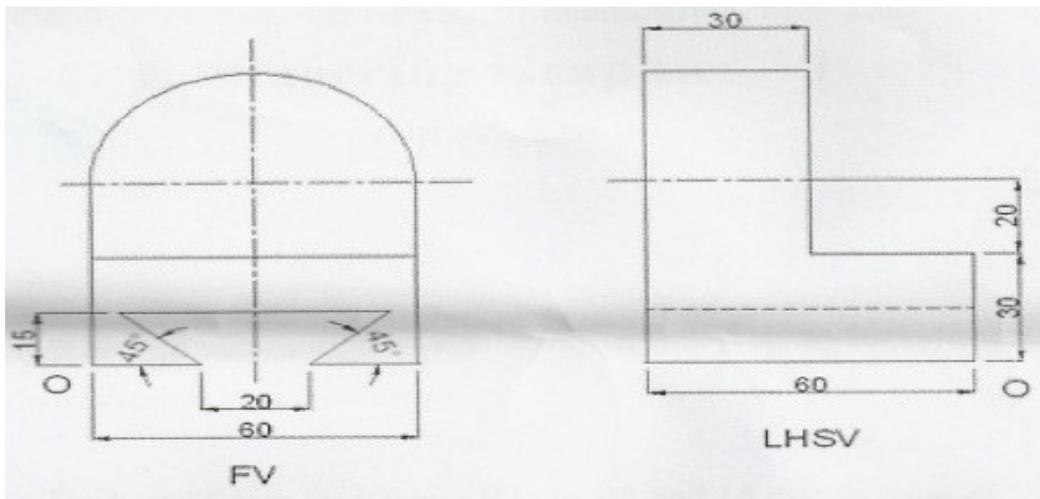
ii. Right hand side view [4]

iii. Top view [4]

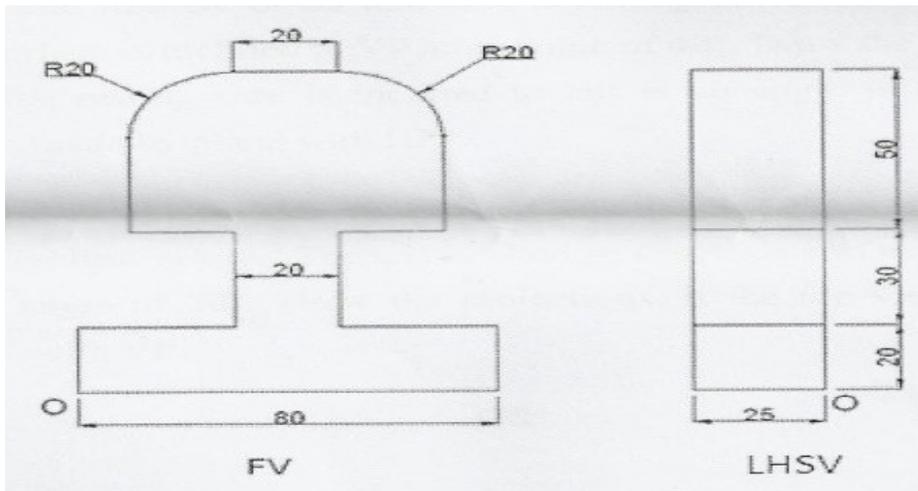
iv. Dimensions [1]



Q7 Figure 3 shows front view and end view of a bracket. Draw isometric view and show overall dimensions. [12]



Q8 Figure 4 shows front view and end view of an object. Draw isometric view and show overall dimensions. [12]



Total No. of Questions: 8

Total No. of Pages: 2

University of Pune  
F. E. (Semester – I) Phase IV Examination

**ENGINEERING GRAPHICS – I**

**[4361]-107**

(2012 Pattern)

Time: 2 Hrs.]

[Max. Marks: 50

Instructions:

1. Use only half imperial size drawing sheet as answer book.
2. Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 & Q.7 or Q.8
3. Retain all construction lines.
4. Assume suitable data if necessary

**Q.1** The point A of 80 mm long line AB is 20 mm above HP and 60 mm in front of VP. **12**  
The end point B is 15 mm in front of VP, while its plan measures 65 mm. Draw the projections of a line, and find the inclinations made by the line with HP and VP. Also, locate the traces of line.

OR

**Q.2** The point P of a line PQ is 25 mm above HP while its end point Q is 15 mm in front of **12**  
VP. Its plan and elevation makes  $40^\circ$  and  $35^\circ$  with XY respectively. Draw the projections; if the projector distance between the end points of line PQ is 60 mm. Find the inclinations made by the line with HP and VP. Also, locate the traces of line.

**Q.3** An isosceles triangular plate with base 60 mm and altitude 80 mm has its base in HP **13**  
and inclined at  $45^\circ$  to VP. Its surface is inclined to HP so that its top view is an equilateral triangle. Draw its projections. Find the inclination made by the plate with HP and VP.

OR

**Q.4** A pentagonal plate of side 40 mm is held on VP on one of its corner and the edge opposite to that corner makes an angle of  $25^\circ$  with the HP. The surface of pentagonal plate is inclined at  $40^\circ$  to VP. Draw the projections and find the inclination made by the plate with HP. **13**

**Q.5 A** Draw a parabola by focus-directrix method, if the distance of focus from the directrix is 70 mm. **6**

**B** Draw a helix of one revolution to a cylinder of base diameter 60 mm and axis height 100 mm. **6**

OR

**Q.6 A** Draw an ellipse, having major and minor axes 120 mm and 70 mm respectively by rectangle method. **6**

**B** Draw an involute of a circle, with diameter 40 mm for one convolution. **6**

**Q.7** A tetrahedron of 70 mm long edges has one edge on the HP and inclined at  $45^\circ$  to VP. Draw the projections, if its apex is 45 mm above HP. **13**

OR

**Q.8** A cylinder of base diameter 60 mm and axis height 80 mm is resting in HP on one of its base circumference point. Draw the projections if its axis is inclined to HP at  $30^\circ$  and VP at  $35^\circ$ . **13**

**UNIVERSITY OF PUNE**  
**[4361-108]**  
**F.E. Examination 2013**  
**Engineering Mathematics -II**  
**(2012 pattern)**

**Time-Two hours**

**[Total No. of Question=8]**

**Instructions:**

- (1) Attempt 4 questions : Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- (2) Neat diagrams must be drawn wherever necessary.
- (3) Figures to the right indicate full marks.
- (4) Use of electronic non-programmable calculator is allowed.
- (5) Assume suitable data whenever necessary.

**Maximum Marks-50**

**[Total no. of printed pages= 3]**

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**SECTION-I**

Q.1 (a) Solve the following differential equations. (8)

(i)  $(x^4 e^x - 2mxy^2) dx + 2mx^2 y dy = 0$

(ii)  $\left( \tan \frac{y}{x} - \frac{y}{x} \sec^2 \frac{y}{x} \right) dx + \sec^2 \frac{y}{x} dy = 0$

(b) A constant electromotive force  $E$  volts is applied to a circuit containing a constant resistance  $R$  ohms in series and a constant inductance  $L$  henries. If the initial current is zero, show that the current builds up to half its theoretical

maximum in  $\frac{L \log 2}{R}$  seconds. (4)

OR

Q.2 (a) Solve  $\left[ \log(x^2 + y^2) + \frac{2x^2}{x^2 + y^2} \right] dx + \frac{2xy}{x^2 + y^2} dy = 0$  . (4)

(b) Solve the following:- (8)

(1) A particle is moving in a straight line with an acceleration  $k \left[ x + \frac{a^4}{x^3} \right]$  directed towards origin. If it starts from rest at a distance 'a' from the origin, prove that it will arrive at origin at the end of time  $\frac{\pi}{4\sqrt{k}}$ .

(2) A pipe 10cm in diameter contains steam at  $100^\circ C$ . It is covered with asbestos, 5cm thick, for which  $k=0.0006$  and the outside surface is at  $30^\circ C$ . Find the amount of heat lost per hour from a meter long pipe.

Q.3 (a) Express  $f(x) = \pi^2 - x^2, -\pi \leq x \leq \pi$  as a fourier series, where  $f(x) = f(x + 2\pi)$ . (5)

(b) Evaluate  $\int_0^\infty \frac{x^8 - x^{14}}{(1+x)^{24}} dx$ . (3)

(c) Trace the curve (Any one) (4)

(i)  $y^2 = x^2(1-x)$

(ii)  $r = 2\sin 3\theta$

OR

Q.4 (a) show that the length of an arc of the curve  $x = \log(\sec \theta + \tan \theta) - \sin \theta, y = \cos \theta$  from  $\theta=0$  to  $\theta=t$  is  $\log(\sec t)$ . (4)

(b) Evaluate:  $\int_0^\pi x \sin^5 x \cos^2 x dx$ . (4)

(c) Evaluate  $\int_0^1 \left[ \frac{x^m - 1}{\log x} \right] dx$ . (4)

Q.5 (a) Find the equation of the sphere, having its center on the plane  $4x - 5y - z = 3$  and passing through the circle.  $x^2 + y^2 + z^2 - 2x - 3y + 4z + 8 = 0, x - 2y + z = 8$ . (5)

(b) Find the equation of a right circular cone, having vertex at the point  $(0,0,3)$  and passing through the circle  $x^2 + y^2 = 16, z=0$ . (4)

(c) Find the equation of a right circular cylinder of radius 2, whose axis passes through the point (1,1,-2) and has direction cosines proportional to 2,1,2. (4)

OR

Q.6 (a) Find the equation of the sphere which is tangential to the plane  $4x - 3y + 6z - 35 = 0$  at (2,-1,4) and passing through the point (2,-1,-2). (5)

(b) Find the equation of a right circular cone with vertex at origin, the line  $x = y = 2z$  as the axis and semi-vertical angle  $30^\circ$ . (4)

(c) Find the equation of a right circular cylinder whose axis is  $2(x-1) = y+2 = z$  and radius is 4. (4)

Q.7 Solve any two:

(a) Evaluate  $\int_0^a \int_{y^2/a}^y \frac{y dx dy}{(a-x)\sqrt{ax-y^2}}$  (7)

(b) Evaluate  $\int \int \int_V \sqrt{x^2+y^2} dx dy dz$ , where  $V$  is bounded by the surface  $x^2 + y^2 = z^2$ ,  $z \geq 0$  and the plane  $z=1$ . (6)

(c) Find the Moment of Inertia (M.I) about the line  $\theta = \frac{\pi}{2}$  of the area enclosed by the curve  $r = a(1 + \cos \theta)$ . (6)

OR

Q.8 Solve any two:

(a) Find by double integration the area between the curve  $y^2 x = 4a^2(2a - x)$  and its asymptote. (7)

(b) Find the volume of the cylinder  $x^2 + y^2 = 2ax$  intercepted between the paraboloid  $x^2 + y^2 = 2az$  and  $xoy$  - plane. (6)

(c) Find the centre of gravity (C.G.) of one loop of the curve  $r = a \sin 2\theta$ . (6)

UNIVERSITY OF PUNE  
[4361]-111  
F. E.(Common)Examination - 2013  
ENGINEERING MECHANICS  
(2012 Pattern)

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

[Total No. of Printed Pages :6]  
[Max. Marks : 50]

- (1) Answer **Q1 or Q2, Q3 or Q4, Q5 or Q6** .
- (2) Answers to the **two sections** should be written in **separate answer-books**.
- (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.
- (7) Use of cell phone is prohibited in the examination hall.

Q1 a) The resultant of two forces P and Q is 1200 N vertical. [4]

Determine the force Q and the corresponding angle  $\theta$  for the system of forces as shown in **Fig. 1a**.

b) The  $4.5 \times 10^6$  kg tanker is pulled with constant acceleration of  $0.001 \text{ m/s}^2$  using cable that makes an angle of  $15^\circ$  with the horizontal as shown in **Fig. 1 b**. Determine the force in the cable using Newton's second law of motion. [4]

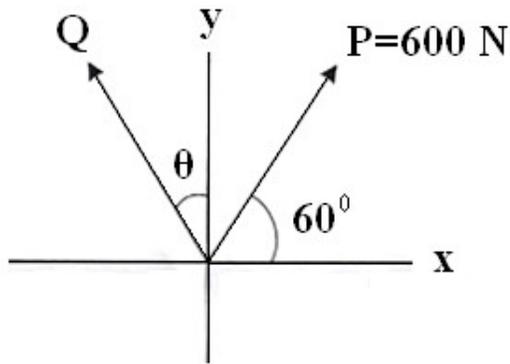


Fig. 1 a

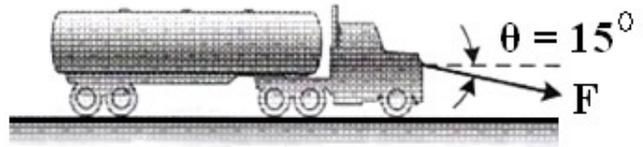


Fig. 1 b

- c) During a race the dirt bike was observed to leap up off the small hill at [4]  
 A at an angle of  $60^\circ$  with the horizontal as shown in **Fig. 1c**. If the point  
 of landing is 6 m away, determine the approximate speed at which the  
 bike was travelling just before it left the ground.
- d) A woman having a mass of 70 kg stands in an elevator which has a [4]  
 downward acceleration of  $4 \text{ m/s}^2$  starting from rest. Determine the work  
 done by her weight and the normal force which the floor exerts on her  
 when the elevator descends 6 m.

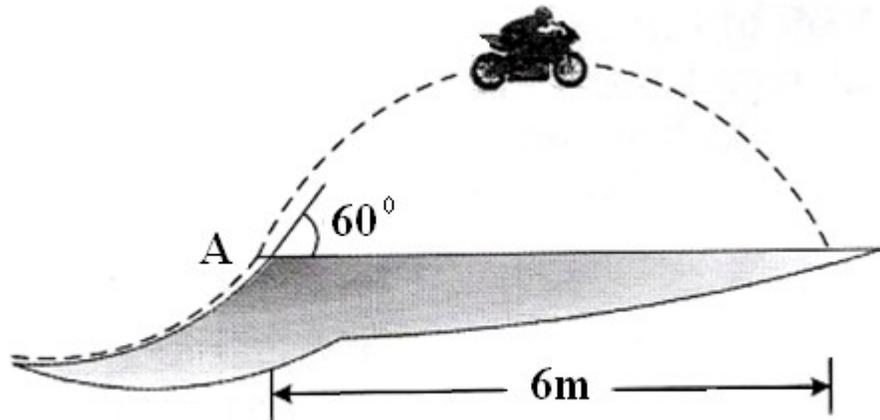


Fig. 1 c

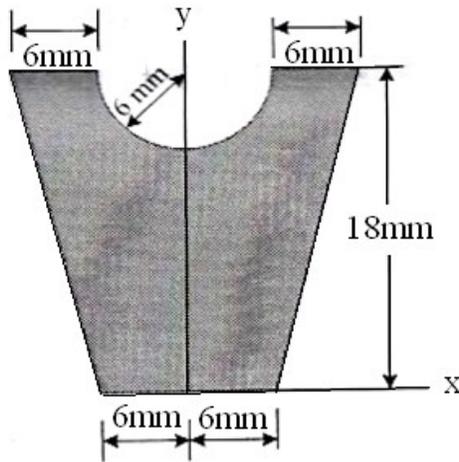
OR

- Q2 a) Determine the y coordinate of centroid of the shaded area as shown [4]  
 in **Fig. 2a**.
- b) A girl having mass of 25kg sits at the edge of the merry go-round so [4]  
 her centre of mass G is at a distance of 1.5 m from the centre of rotation

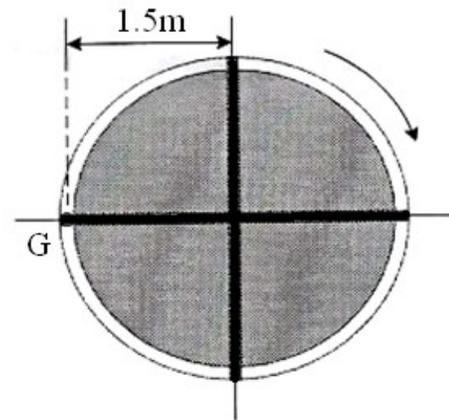
as shown in **Fig. 2b**. Neglecting tangential component of acceleration, determine the maximum speed which she can have before she begins to slip off the merry go-round. The coefficient of static friction is  $\mu_s = 0.3$ .

Use Newton's second law of motion.

- c) A baseball is thrown downward from a 15 m tower with an initial speed of 5 m/s. determine the speed at which it hits the ground and the time of travel. [4]
- d) A ball has a mass of 30 kg and is thrown upward with a speed of 15 m/s. Determine the time to attain maximum height using impulse momentum principle. Also find the maximum height. [4]



**Fig. 2 a**



**Fig. 2 b**

- Q3 a) The motor at B winds up the cord attached to the 65 N crate with a constant speed as shown in **Fig. 3a**. Determine the force in cord CD supporting the pulley and the angle  $\theta$  for equilibrium. Neglect the size of pulley at C. [6]
- b) The boom supports the two vertical loads  $P_1 = 800$  N and  $P_2 = 350$  N as shown in **Fig. 3b**. determine the tension in cable BC and component of reaction at A. [6]

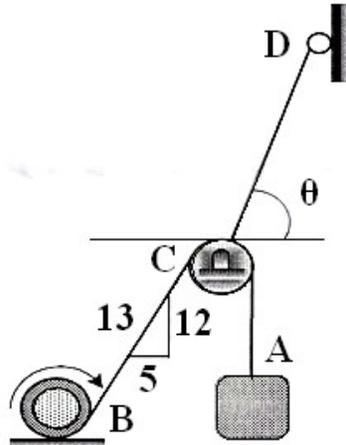


Fig.3 a

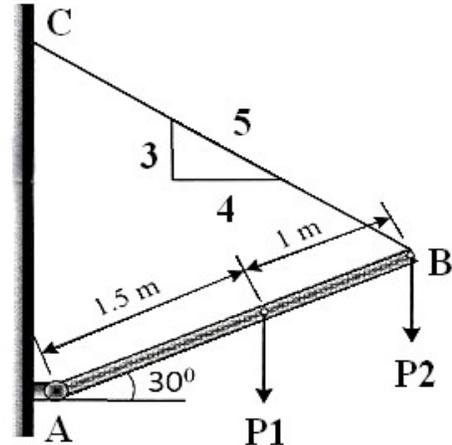


Fig. 3 b

- c) A concrete foundation mat in the shape of regular hexagon with 3 m side support column loads as shown in Fig. 3c. Determine the magnitude of the additional loads  $P_1$  and  $P_2$  that must be applied at B and F if resultant of all six loads is to pass through the centre of the mat.

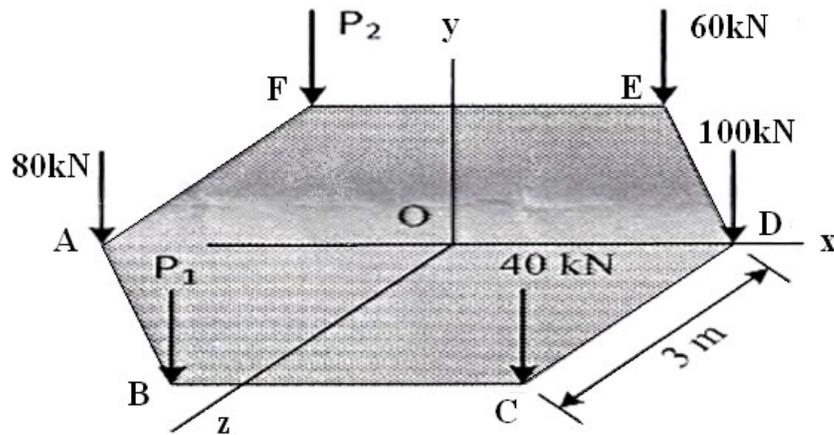


Fig. 3 c

OR

- Q4 a) The rope BC will fail when the tension becomes 50 kN as shown [6]  
 In Fig. 4a. Determine the greatest load P that can be applied to the beam  
 At B and reaction at A for equilibrium.
- b) The three cables are used to support the 800 N lamp as shown in Fig. [6]  
 4b. Determine the force developed in each cable for equilibrium.
- c) State and explain active forces, reactive forces and free body diagram [5]

with suitable example.

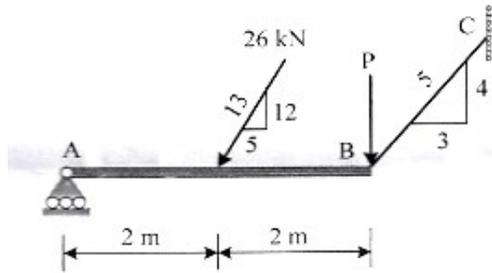


Fig. 4 a

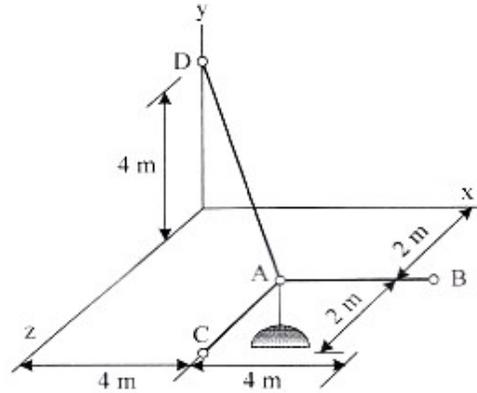


Fig. 4 b

- Q5 a) Determine the magnitude and nature of forces in the members BC, HC [6]  
 And HG of the truss loaded and supported as shown in Fig. 5a.
- b) The 15 m ladder has a uniform weight of 80 N and rest against the [6]  
 smooth wall at B as shown in Fig. 5b. If the coefficient of static friction  
 $\mu_s = 0.4$ , determine if the ladder will slip?
- c) Define angle of repose, angle of friction, coefficient of friction and [5]  
 cone of friction with sketches.

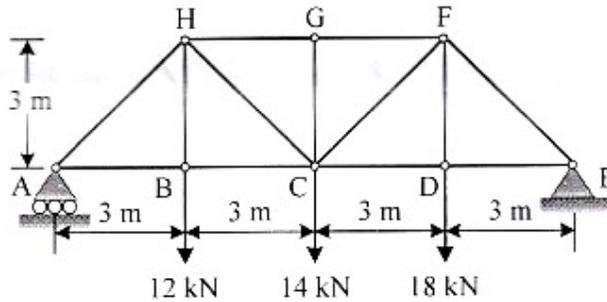


Fig. 5 a

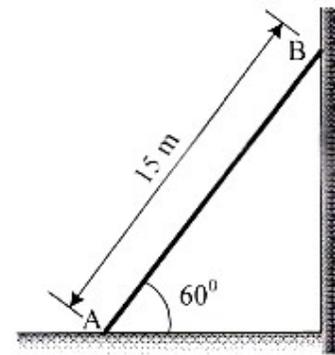
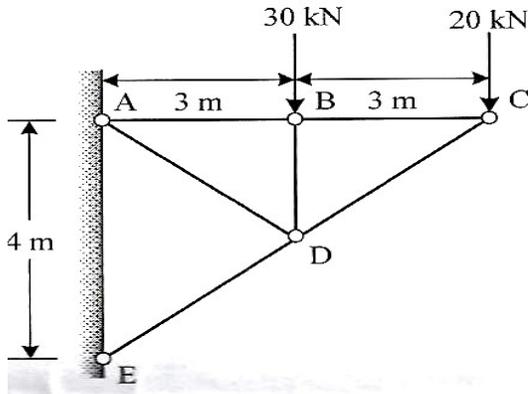


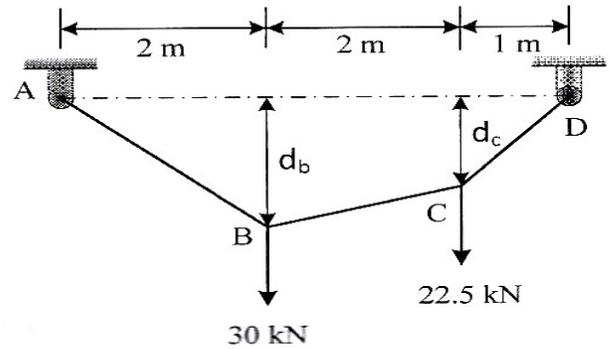
Fig. 5 b

OR

- Q6 a) Determine the forces in each member of the truss and state if the [6]  
 members are in tension or compression. Refer Fig. 6a.
- b) Two loads are suspended as shown in Fig. 6 b from cable ABCD. [6]  
 knowing that  $d_c = 0.75$  m and  $d_b = 1.125$  m, determine the component  
 of reaction at A maximum tension in the cable.

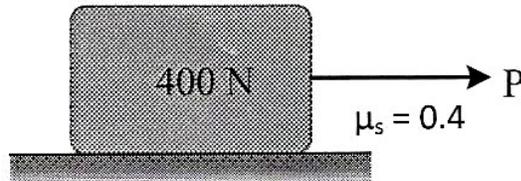


**Fig. 6 a**



**Fig. 6 b**

- c) A 400 N block is resting on a rough horizontal surface as shown in [5]  
**Fig. 6c** for which the coefficient of friction is 0.4. Determine the force  $P$  required to cause motion if applied to the block horizontally. What minimum force is required to start motion?



**Fig. 6 C**

**UNIVERSITY OF PUNE**  
**[4361]-114**  
**F. E. (Mechanical Engineering)**  
**Examination-2013**  
**BASIC MECHANICAL**  
**ENGINEERING**  
**(2012 Pattern)**

[Time: 2 Hours] [Max. Marks: 50]  
[Total No. Of Questions: 08] [Total No. Of Printed Pages: 2]

**Instructions:**

- (1) Assume suitable data, if necessary.
- (2) Neat diagrams must be drawn wherever necessary.
- (3) Use of Calculator is permitted.

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Q1) A) Explain with neat sketch flange coupling. [06]  
B) Explain the factors affecting the selection of material. [06]

**OR**

Q2) A) Differentiate between flat belt drive and V belt drive. [06]  
B) Write a note on four bar mechanism. [06]

Q3) A) Explain with sketches the different stages involved in manufacturing of sand casting. [07]  
B) With neat sketches explain surface grinding and cylindrical grinding operations. [06]

**OR**

Q4) A) Explain with neat sketch the major parts of a center lathe machine. [07]  
B) Draw self explanatory sketches of various operations performed in sheet metal working. [06]

Q5) A) Define thermodynamic system. Explain its types with examples. [04]  
B) Explain second law of thermodynamics for heat engine. [04]  
C) A heat engine operates between source and sink temperatures of  $235^{\circ}\text{C}$  and  $30^{\circ}\text{C}$  respectively. If heat engine receives 35KW from the source, find the net work done by the engine, the heat rejected to the sink by the engine and the efficiency of engine. Draw the

sketch of system. [05]

**OR**

Q6) A) State various statements and limitations of first law of thermodynamics. [04]

B) Define: Heat source, Heat sink, Thermal efficiency and Coefficient of performance. [04]

C) A U tube manometer is used to measure the pressure of a gas in the pipe. The level of liquid in the manometer arm open to the atmosphere is 170 mm lower than the level of the liquid connected to the gas pipe. The liquid in the manometer has specific gravity of 0.8. Find the absolute pressure of the gas if barometer reads 76 cm of mercury. Take the density of mercury as  $13600 \text{ Kg/m}^3$ . Draw the sketch of system. [05]

Q7) A) Differentiate between fire tube boiler and water tube boiler. [06]

B) With neat sketches explain principle of working of four stroke petrol engine. [06]

**OR**

Q8) A) Write a note on hydro-electric power plant. [06]

B) With neat sketch explain window air conditioner. [06]