Total No. of Questions : 9]

SEAT No. :

P6485

[Total No. of Pages : 4

[5868]-101

F.E. (Semester- I & II)

ENGINEERING MATHEMATICS - I

(2019 Pattern) (107001)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Q. 1 is compulsory.***
2) ***Attempt Q2 or Q3, Q4 or Q5,Q6 or Q7, Q8 or Q9.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use of electronic pocket calculator is allowed.***
6) ***Assume suitable data, if necessary.***

Q1) Write the correct option for the following multiple choice questions.

a) If eigen value of a square matrix A is zero then. **[1]**

i) A is non-singular ii) A is orthogonal

iii) A is singular iv) None of these

b) If u = y^x then $\dfrac{\partial u}{\partial x}$ is equal to **[1]**

i) 0 ii) xy^{x-1}

iii) $y^x \log y$ iv) None of these

c) The orthogonal transformation x = py transforms the quadratic form $Q = x_1^2 + 3x_2^2 + 3x_3^2 - 2x_2x_3$ to the canonical form $Q' = y_1^2 + 2y_2^2 + y_3^2$. The rank of quadratic from is **[2]**

i) 2 ii) 3

iii) 1 iv) 0

d) $u = \sec^{-1}\left[\dfrac{x^2+y^2}{xy^2}\right]$. Find the value of $x\dfrac{\partial u}{\partial x} + y\dfrac{\partial u}{\partial y}$ **[2]**

i) –tan u ii) –cot u

iii) tan u iv) cot u

P.T.O.

e) If u = $x^2 - y^2$ and v = $2xy$ then the value of $\frac{\partial(u,v)}{\partial(x,y)}$ is **[2]**

i) $4(x^2 + y^2)$ ii) $-4(x^2 + y^2)$

iii) $4(x^2 - y^2)$ iv) 0

f) A system of linear equations Ax = B, where B is a null (zero) matrix is **[2]**

i) Always consistent

ii) Consistent only if |A| = 0

iii) Consistent only if |A| ≠ 0

iv) In consistent if ρ (A) < No. of variables

Q2) a) If $z = \tan(y + ax) + (y - ax)^{3/2}$ find value of $\frac{\partial^2 z}{\partial x^2} - a^2 \frac{\partial^2 z}{\partial y^2}$. **[5]**

b) If $u = \tan^{-1}\left(\frac{x^3 + y^3}{x - y}\right)$ then prove that

$$x^2 \frac{\partial^2 u}{\partial x^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} + y^2 \frac{\partial^2 u}{\partial y^2} = \left(1 - 4\sin^2 u\right)\sin 2u$$ **[5]**

c) If $u = f\left(x^2 - y^2; y^2 - z^2; z^2 - x^2\right)$ find value of $\frac{1}{x}\frac{\partial u}{\partial x} + \frac{1}{y}\frac{\partial u}{\partial y} + \frac{1}{z}\frac{\partial u}{\partial z}$ **[5]**

OR

Q3) a) If $u = ax + by\,; v = bx - ay$ find value of $\left(\frac{\partial u}{\partial x}\right)_y \left(\frac{\partial x}{\partial u}\right)_v \left(\frac{\partial y}{\partial v}\right)_x \left(\frac{\partial v}{\partial y}\right)_u$ **[5]**

b) If $u = \sin^{-1}\left(\sqrt{x^2 + y^2}\right)$ then find value of $x^2 \frac{\partial^2 u}{\partial x^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} + y^2 \frac{\partial^2 u}{\partial y^2}$ **[5]**

c) If $u = f(r,s)$ where $r = x^2 + y^2$; S = $x^2 - y^2$ then show that

$$y\frac{\partial u}{\partial x} + x\frac{\partial u}{\partial y} = 4xy\frac{\partial u}{\partial r}.$$ **[5]**

Q4) a) If $x = uv$ and $y = \frac{u+v}{u-v}$, find $\frac{\partial(u,v)}{x,y}$. **[5]**

b) Examine for functional dependence $u = \frac{x-y}{1+xy}, v = \tan^{-1}x - \tan^{-1}y$ and if depedent find the relation between them. **[5]**

c) Discuss maxima and minima of $f(x,y) = x^2 + y^2 + 6x + 12$ **[5]**

OR

Q5) a) Prove JJ′ = 1 for $x = u$ cosv, y = u sinv. **[5]**

b) In calculating the volume of a right circular cone, errors of 2% and 1% are made in measuring the height and radius of base respectively find the error in the calculated volume. **[5]**

c) Find maximum value of $u = x^2y^3z^4$ such that $2x + 3y + 4z = a$ by Langrange's method. **[5]**

Q6) a) Investigate for what values of μ & λ the equations $x+y+z = 6$, $x+2y+3z = 10$, $x+2y+\lambda z = \mu$ have i) No solution ii) Infinitely many solutions. **[5]**

b) Examine for linear dependence and independence the vectros (1,1,3), (1,2,4), (1,0,2). If dependent, find the relation between them. **[5]**

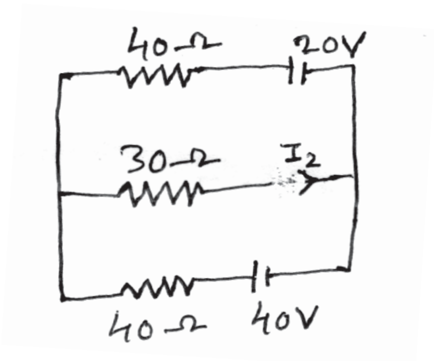
c) Verify whether matrix $A = \begin{bmatrix} \cos\theta & 0 & \sin\theta \\ 0 & 1 & 0 \\ -\sin\theta & 0 & \cos\theta \end{bmatrix}$ is orthogonal or not. **[5]**

OR

Q7) a) Solve the system of equations $x+y+2z = 0$, $x+2y+3z=0$, $x+3y+4z=0$. **[5]**

b) Examine following vectors for linear dependence and independence (1,–1,1), (2,1,1), (3,0,2). If dependent, find the relation between them. **[5]**

c) Determine the currents in the network given in the figure . **[5]**



Q8) a) Find the eigen values of the matrix $A=\begin{bmatrix} 1 & -2 \\ -5 & 4 \end{bmatrix}$. **[5]**

Find eigen vector corresponding to the highest eigen value.

b) Verify cayley-Hamilton theorem for $A=\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$. Hence find A^{-1} if it exists. **[5]**

c) Find the modal matrix p which diagonalises $A=\begin{bmatrix} 5 & 3 \\ 3 & 5 \end{bmatrix}$. **[5]**

OR

Q9) a) Find the eigen values of $A=\begin{bmatrix} 1 & 2 & 3 \\ 0 & 3 & 2 \\ 0 & 0 & -2 \end{bmatrix}$. **[5]**

Find eigen vector corresponding to the highest eigen value.

b) Verify cayley-Hamilton theorem for $A=\begin{bmatrix} 1 & 0 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$ **[5]**

c) Reduce the quadratic form $Q = x_1^2 + 2x_2^2 + x_3^2 + 2x_2x_3 - 2x_3x_1 + 2x_1x_2$ to canonical form by congruent transformations. **[5]**

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Total No. of Questions : 09]

SEAT No. :

P6486

[Total No. of Pages : 4

[5868]-102
F.E. (Semester - II)
Engineering Physics
(2019 Pattern) (Paper - II) (107002)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) *Question No. 1 is compulsory.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicates 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.*

Physical Constants :-

1)	*Planck's constant*	$h = 6.63 \times 10^{-34}$ J–S
2)	*Mass of electron*	$m_e = 9.1 \times 10^{-31}$ kg
3)	*Charge on electron*	$e = 1.6 \times 10^{-19}$ C

Q1) Write the correct option with answer for the following : **[10]**

i) The wavelength λ associated with a particle of mass m moving with velocity v is given by

a) $\lambda = \frac{h}{mv}$ b) $\lambda = \frac{mv}{h}$

c) $\lambda = \frac{hv}{m}$ d) $\lambda = \frac{m}{hv}$

ii) The equation of motion of matter wave was derived by

a) Heisenberg b) Bohr

c) De Broglie d) Schrodinger

iii) In metals the band gap energy / forbidden energy gap is

a) 0 eV b) 0.7 eV

c) 1.12 eV d) > 5 eV

iv) A solar cell work on the principle of

a) Photoelectric effect　b) Photoluminescence effect

c) Photovoltaic effect　d) Photocombustion effect

v) The relative permeability can be expressed by

a) $\mu_r = 1 + \mu_0$　b) $\mu_r = 1 + x$

c) $\mu_r = x/\mu_0$　d) $\mu_r = \mu_0 + \mu_a$

vi) Superconductivity is the phenomenon in which ________ of materials suddenly disappears below critical temperature.

a) Capacitance　b) Conductivity

c) Inductance　d) Resistance

vii) Ultrasonic waves have frequency

a) Less than 20 H_z　b) 20 H_z to 20 kH_z

c) Greater than 20 kH_z　d) None of the above

viii) In nanomaterials which of the following statement is correct.

a) Surface to volume ratio is very small

b) Surface to volume ratio is large

c) Surface to volume ratio is 1 (unity)

d) None of the above

Q2) a) Derive an equation for energy of a particle enclosed in 1D rigid box or in an infinite potential well. **[6]**

b) What is wave function Ψ? Write mathematical conditions of well behaved wave function. **[5]**

c) An electron is accelerated by a potential difference of 10 kV. What is De Broglie wavelength associated with this electron. **[4]**

OR

Q3) a) Starting from De Broglie hypothesis, derive Schrodinger's time independent wave equation. **[6]**

b) State Heisenberg's Uncertainly principle. Explain it using the concept of narrow and broad wave packet. **[5]**

c) Lowest energy of an electron in a potential well is 38 eV. Calculate the width of well. **[4]**

Q4) a) Derive an expression for conductivity of intrinsic, and extrinsic semiconductors. **[6]**

b) What is fermi level in a semiconductor? With the neat labelled diagram, draw the position of fermi level in N Type & P Type semiconductor at 0º K. **[5]**

c) A coper strip 2.0 m wide, 1.0 mm thick is placed in a magnetic field of 1.5T. If a current of 200 A is set up in the strip, calculate the Hall voltage that appears across the strip. **[5]**

Assume $R_H = 6 \times 10^{-7}$ m^3/C.

OR

Q5) a) State Hall effect. Derive an equation of Hall voltage. **[6]**

b) Define fermi level in conductors and semiconductors. Draw the position of fermi level in intrinsic, N - type & P - type semiconductors. **[5]**

c) Calculate the number of acceptors to be added to germanium sample to obtain the resistivity of 10Ωm. **[4]**

Q6) a) Explain the following terms in superconductivity : **[6]**

i) Critical Magnetic field.

ii) Meissner effect

b) Define : **[5]**

i) Magnetic induction (B)

ii) Magnetic field strength (H)

iii) Magnetization (M) and state the relation between B, M & H.

c) Explain DC & AC Josephson effect in brief. **[4]**

OR

Q7) a) Differentiate between Diamagnetism, paramagnetism and ferromagnetism. (Any Three points) **[6]**

b) What is superconductivity? Distinguish between Type I and Type II superconductors. (any four points) **[5]**

c) The transition temperature for lead is 7.2 K. However at 5K it losses the superconductivity property if subjected to magnetic field of 3.3×10^4 A/m. Find the maximum value of magnetic field which will allow the metal to retain its superconductivity at 0K. **[4]**

Q8) a) What is echo sounding technique? Using this technique explain non destructive testing for the measurement of thickness of metal sheet using ultrasonic waves. **[6]**

b) What are nanoparticles? What is nanotechnology? Explain the optical property of nanoparticle. **[5]**

c) Distinguish between Destructive and Non Destructive testing (any two points) **[4]**

OR

Q9) a) What are applications of nanoparticles? Explain any two applications of nanoparticles in brief. **[6]**

b) Explain in brief Acoustic Emission Technique of NDT and its application. **[5]**

c) Explain electrical property of nanoparticles. **[4]**

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Total No. of Questions : 9]

SEAT No. :

P6487

[Total No. of Pages : 4

[5868]-103
F.E. (Semester - I & II)
ENGINEERING CHEMISTRY
(2019 Pattern) (Paper - II) (107009)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Questions No. 1 is compulsory. Solve Q.No. 2 or Q.No. 3, Q.No. 4 or Q.No. 5, Q.No. 6 or Q.No. 7 and Q.No. 8 or Q.No. 9.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicates 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.***

Q1) Multiple choice questions -

i) PPV shows ______ fluorescence on application of electric field and can be used in _______. **[2]**

A) blue, sutures B) yellow-green, organic LEDs

C) red, eye-wear lenses D) violet, drug - delivery

ii) C atoms in graphene show ______ hybridisation. **[1]**

A) sp^3 B) sp

C) sp^2 D) sp^3d^2

iii) Power alcohol is advantageous because it ________. **[1]**

A) decreases octane number B) burns clean

C) increases calorific value D) increases cetane number

iv) Units of calorific value are _________. **[1]**

A) Cal/g B) Cal/m

C) Joules D) Kg/m^3

P.T.O.

v) CO_2 is _________ and shows ________ fundamental modes of vibration. **[2]**

A) linear, 3
B) non-linear, 3
C) linear, 4
D) non-linear, 4

vi) Electromagnetic radiations with wavelength 10-400 nm are called ______ radiations. **[1]**

A) Visible
B) Microwave
C) IR
D) Ultra violet

vii) Tinning is coating of ______. **[1]**

A) Fe on Sn
B) Zn on Fe
C) Sn on Fe
D) Fe on Zn

viii) Rate of corrosion _______ with increase in purity of the metal. **[1]**

A) decreases
B) increases
C) remains same
D) initially increases and then remains constant

Q2) a) What are biodegradable polymers? Explain three factors responsible for biodegradation. Give two properties and two uses of biodegradable polymer. **[6]**

b) What are nanomaterials? Discuss in brief two properties and applications of nanomaterials. **[5]**

c) Give the structure and three properties and applications each of polycarbonate. **[4]**

OR

Q3) a) What are carbon nano-tubes? Discuss the different types of carbon nanotubes with respect to their structure. **[6]**

b) Explain the structure of graphene with the help of diagram and mention its two properties and two applications. **[5]**

c) What are conducting polymers? State the structural requirements for a polymer to be conducting and give any three applications of conducting polymers. **[4]**

Q4) a) What is proximate analysis of coal? Give the procedure and formula for determination of each constituent. **[6]**

b) Explain the production of hydrogen by steam reforming of coke and methane with reaction conditions. **[5]**

c) The following data was obtained in a Boy's gas

Calorimeter experiment -

Volume of gas burnt at STP = $0.1m^3$

Mass of cooling water = 30 kg

Rise in temperature of cooling water = 8.1°C

Mass of steam condensed = 0.08 kg

Calculate GCV and NCV of the fuel **[4]**

OR

Q5) a) Give the principle and explain the process of fractional distillation of crude oil with labelled diagram. Give the composition and boiling range of any one fraction obtained during refining. **[6]**

b) Give the preparation reaction of biodiesel. State four advantages and two limitations of biodiesel. **[5]**

c) 1.0g of coal sample on complete combustion increased the weight of U-tube containing $CaCl_2$ by 0.5g and tube containing KOH by 2.4g. Calculate % of C and H in the given coal sample. **[4]**

Q6) a) Draw block diagram of IR spectrophotometer. Explain its any four components and give their function. **[6]**

b) Explain the possible transitions which occur on absorption of UV-Vis radiations by an organic molecule. **[5]**

c) Explain any four applications of IR spectroscopy. **[4]**

OR

Q7) a) Draw block diagram of single beam UV-vis spectrophotometer. Explain its four components and give their function. **[6]**

b) Give the principle of IR spectroscopy. Explain fundamental modes of bending vibrations. **[5]**

c) Define the following terms - **[4]**

i) Chromophore

ii) Hypsochromic shift

iii) Auxochrome

iv) Hypochromic shift

Q8) a) Explain hydrogen evolution and oxygen absorption mechanism of wet corrosion. **[6]**

b) What is electroplating? Explain the process with diagram and reactions. Give applications of electroplating. **[5]**

c) What are anodic and cathodic coatings? Which are better and why? **[4]**

OR

Q9) a) State Pilling Bedworth ratio and give its significance. Give the different types of oxide films with suitable example formed during the oxidation corrosion of metals. **[6]**

b) Explain any five factors affecting the rate of corrosion. **[5]**

c) What is the principle of cathodic protection? Explain any one method of cathodic protection. **[4]**

Total No. of Questions : 8]

SEAT No. :

P6488

[Total No. of Pages : 2

[5868]-104
F.E.
SYSTEMS IN MECHANICAL ENGINEERING
(2019 Pattern) (Semester - II) (102003)

Time : 2½ Hours] ***[Max. Marks : 70***

Course Outcome :

CO 3 : List down the types of road vehicles and their specifications.

CO 4 : Illustrate various basic parts and transmission system of a road vehicle.

CO 5 : Discuss several manufacturing processes and identify the suitable process.

CO 6 : Explain various types of mechanism and its application.

Instructions to the candidates:

1) ***Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.***
2) ***Assume suitable data if necessary.***
3) ***Figures to the right indicate full marks.***

Q1) a) Define Vehicle Specification. Explain following Engine specification. **[7]**

i) Power of Engine

ii) Cylinder Capacity

iii) Type of Transmission

b) Explain Electric Vehicle with neat diagram. **[7]**

c) Draw four stroke S I Engine diagram and labeled engine component on it. **[4]**

OR

Q2) a) Write short note on hybrid vehicle. Name any one example. **[7]**

b) Classify Automobile, Compare specification of two wheeler and LMV (two points). **[7]**

c) Write short note cost analysis of Vehicle. **[4]**

Q3) a) Expalain ABS system with neat diagram. **[7]**

b) Draw and Explain layout of an Automobile. **[7]**

c) Draw neat diagram of Single Plate Clutch. **[3]**

OR

P.T.O.

Q4) a) Explain water cooling used in vehicle with neat diagram. **[7]**

b) Explain Rear Engine Rear Wheel Drive System with neat diagram. **[7]**

c) Draw neat diagram of Drum Brake. **[3]**

Q5) a) Define and casting process. Write any two advantages, disadvantages and application each. **[7]**

b) Define sheet metal operation. Explain punching and blanking with neat diagram. **[7]**

c) Write short note on CNC Machine. **[4]**

OR

Q6) a) Define Machining operation. Explain turning and drilling operation principal with neat diagram. **[7]**

b) Explain Shielded metal arc welding with neat diagram. Write any one application. **[7]**

c) Write short note on IOT. **[4]**

Q7) a) Explain working of washing machine with neat diagram. **[7]**

b) Explain working of Solar Heater with neat diagram. **[7]**

c) Draw neat diagram of Water Tap. **[3]**

OR

Q8) a) Explain with neat diagram working of vaccum cleaner. **[7]**

b) Explain brake paddle with neat diagram. **[7]**

c) If Refrigerator is used to maintain temperature of 4ºC by removing 60kJ/sec of heat from inside with help of compressor of capacity 30kW. Compute COP of refrigerator. **[3]**

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Total No. of Questions : 8]

SEAT No. :

P6489

[Total No. of Pages : 4

[5868]-105
F.E. (All Branches)
103004 : BASIC ELECTRICAL ENGINEERING
(2019 Pattern) (Semester - I/II)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.***
2) ***Figures to the right indicate full marks.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Assume suitable additional data, if necessary.***
5) ***Use of non-programmable calculator is allowed.***

Q1) a) Define and state the unit of admittance, conductance & susceptance. Also draw the admittance triangle for inductive circuit. **[4]**

b) Obtain the expression for current and power, when voltage $v = V_m \sin \omega t$ is applied across purely resistive circuit. Also draw the waveform for voltage, current & power on common X-axis. **[6]**

c) The series circuit having resistance 5 Ω, inductance 0.1 H and capacitance 150 μF is connected to 1-phase, 200 V, 50 Hz AC supply. Calculate- **[8]**

i) Inductive reactance XL
ii) Capacitive reactance Xc
iii) Net reactance X
iv) Impedance Z
v) Current drawn by the circuit
vi) Power factor
vii) Active power P
viii) Reactive power Q

OR

Q2) a) Define and state the unit of active, reactive and apparent power in case of single phase circuit. Draw the power triangle. **[4]**

b) Derive the expression for resonant frequency and comment on impedance, current and power factor in case of series resonance circuit. **[6]**

c) Derive the expression for power, when voltage $v = V_m \sin \omega t$ is applied across R-L series circuit. Also draw the waveform for voltage, current & power on common X-axis. **[8]**

Q3) a) What is phase sequence? State it's any two applications. **[3]**

b) State the relation between : **[6]**

i) Phase voltage and line voltage

ii) Phase current and line current in case of balanced delta connected 3-ph load. Using above relations, obtain the expressions for 3-ph active power and 3-ph reactive power.

c) A 80 kVA, 1000/250 V, 1-ph 50 Hz transformer has iron loss of 1000 W and copper loss 400 W, when its primary draws current of 50A. Calculate **[8]**

i) Efficiency at full load and power factor = 0.8 lag.

ii) Efficiency at half load and power factor = 1 lag.

OR

Q4) a) What are the losses in the transformer? State the parts in which they take place. **[3]**

b) Derive the EMF equation of single phase transformer. **[6]**

c) Three identical impedances each of 6+j8 Ω are connected in star across 3-ph, 415 V, 50 Hz ac supply. Determine **[8]**

i) Line voltage

ii) Phase voltage

iii) Phase current and line current

iv) 3-ph active, reactive and apparent power

Q5) a) Define the practical voltage source & explain it by means of **[4]**

i) Symbol of representation

ii) Value of internal resistance

iii) Graphs between V and I

b) Derive the equations to convert Delta connected resistive circuit into equivalent Star circuit. **[6]**

c) For the circuit given in fig 5c, write down the steps to find current through PQ using Superposition Theorem. **[8]**

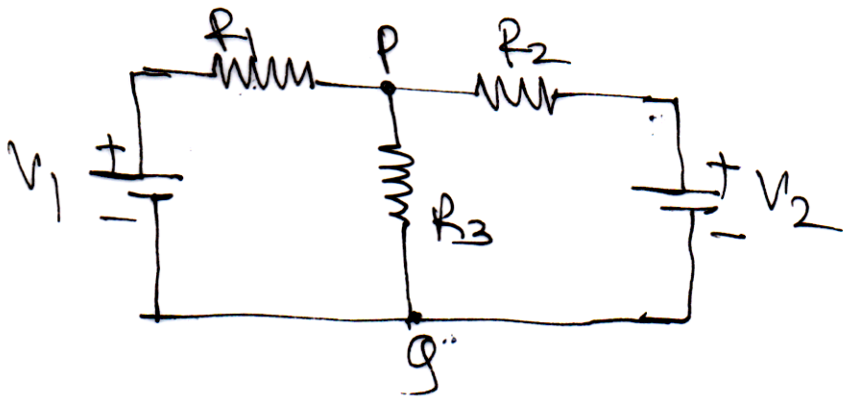

Figure 5c

OR

Q6) a) State and explain KCL & KVL **[4]**

b) Calculate the current flowing through 6 Ω (AB) for the circuit shown in fig 6b, using Kirchhoff's Laws. **[6]**

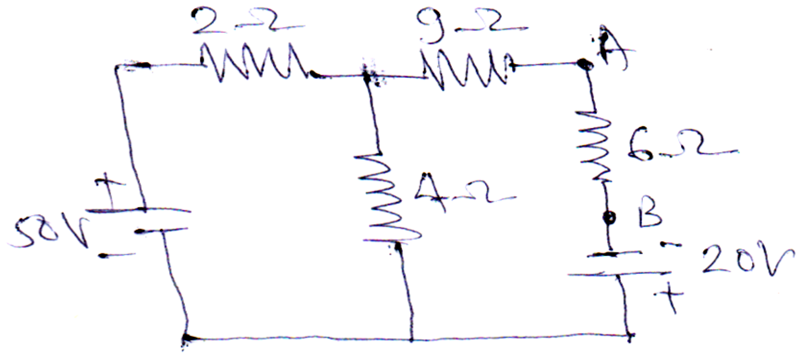

Figure 6b

c) Calculate the current flowing through 6 Ω (AB) for the circuit shown in question 6b, using Thevenin's Theorem. **[8]**

Q7) a) Define resistivity of the material & state the factors on which it depends. **[3]**

b) Explain construction and working principle of Lithium Ion battery and state it's any two applications. **[6]**

c) Derive an expression for insulation resistance of a single core cable. Draw the necessary diagram. Also comment on insulation resistance when **[8]**

i) Two cables are connected in series and

ii) In parallel

OR

Q8) a) Write the name of materials used for anode, cathode and electrolyte in case of Lead Acid Battery. State it's any three applications. **[3]**

b) If α_1 and α_2 are the RTC of a conducting material at t_1^0C and t_2^0C respectively prove that $\alpha_2 = \dfrac{\alpha_1}{1+\alpha_1(t_2 - t_1)}$ **[6]**

c) A water pump lifts 12000 litre of water to a height of 15 m per minute. The efficiency of motor and pump is 75% & 80% respectively. Calculate **[8]**

i) Input power to motor in kW

ii) Daily energy consumption if pump is used 04 hrs a day

iii) Monthly electricity bill as per above daily uses for the month of 30 days at the rate of 10 Rs/unit.

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Total No. of Questions : 8]

SEAT No. :

P6490

[Total No. of Pages : 2

[5868]-106
F.E.
BASIC ELECTRONICS ENGINEERING
(2019 Pattern) (Semester - I & II) (104010)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Solve 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 logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.***
5) ***Assume suitable data if necessary.***

Q1) a) Convert **[6]**

i) $(2BA.OC)_{16}$ to Octal.

ii) $(462.27)_8$ to Hexadecimal

b) Why NAND and NOR are known as universal logic gates? **[6]**

c) Draw and explain block diagram of microprocessor. **[5]**

OR

Q2) a) Perform the following arithmatic operations. **[5]**

i) (110011 – 111001) using 2's compliment method.

ii) (111011.11 + 100100.01)

b) State and prove Demorgon's Theorems. **[6]**

c) Draw and explain block diagram of microcontroller. **[6]**

Q3) a) Explain principle of operation and block diagram Digital Multimeter. **[6]**

b) Explain working of Auto-Transformer List its applications. **[6]**

c) Explain operation of DC Ammeter with suitable diagram. Explain circuit or multi-range Ammeter. **[6]**

OR

Q4) a) Draw block diagram of function generator and explain functions of each block. **[6]**

b) Explain Digital storage oscilloscope. List its applications. **[6]**

c) Explain operation of DC voltmeter with suitable diagram. Explain circuit of multi-range voltmeter. **[6]**

Q5) a) Draw construction of LVDT and explain its operation. Write its advantages, disadvantages and applications. **[6]**

b) Explain RTD with its construction, working, advantages, disadvantages and applications. **[6]**

c) Explain operation of Bio-sensor with one application. **[5]**

OR

Q6) a) What are different types of transducers? Give one example of each type. **[5]**

b) Explain working principle of strain guage. Explain load cell. **[6]**

c) Explain Thermocouple with its construction, working, advantages, disadvantages and applications. **[6]**

Q7) a) Explain different types of cables used in electronic communication. **[6]**

b) Draw and explain block diagram of FM transmitter. **[6]**

c) Draw and explain block diagram of GSM. **[6]**

OR

Q8) a) With the help of block diagram, explain operation of communication system. **[6]**

b) Explain IEEE electromagnetic frequency spectrum and state allotment of frequency bands for different applications. **[6]**

c) Explain block diagram of AM transmitter (High Power). **[6]**

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Total No. of Questions : 9]

SEAT No. :

P6995

[Total No. of Pages : 4

[5868]-107
F.E. (Semester - I & II)
110005 : PROGRAMMING AND PROBLEM SOLVING
(2019 Pattern) (Common)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Question one is compulsory.***
2) ***Solve Q2 or Q3, Q4 or Q5, Q6 or Q7, Q8 or Q9.***
3) ***Neat diagrams must be wherever necessary.***
4) ***Assume suitable data wherever necessary.***

Q1) i) Which one of the following is the correct way of calling a function?

a) f_name() b) call f_name()

c) return f_name() d) function f_name()

ii) What is the correct file extension for Python files?

a) .pt b) .pyt

c) .py d) .cpp

iii) Which function is used to convert a numeric value to a character.

a) ord() b) chr()

c) input() d) output()

iv) Which is the default access mode in the open () function for files in Python?

a) w b) r

c) a d) w+

v) Which method can be used to return a string in upper case letters?

a) toupper() b) upper()

c) uppercase() d) touppercase()

P.T.O.

vi) Which method is automatically executed when an object of a class is created?

a) _init_()　　b) _call_()

c) _repr_()　　d) _del_()

vii) You can use Python for

a) Application programming　　b) Web programming

c) Artificial intelligence　　d) All of these

viii) Which of the following keyword is used in user defined function header in Python?

a) define　　b) def

c) function　　d) fun

ix) What does open() function return?

a) function　　b) variable

c) file object　　d) none of these

x) Which of the following is the correct way of closing a file?

a) close(file)　　b) close("file")

c) file.closed()　　d) file.close()

Q2) a) Define a function. Explain function definition and function call with suitable example. **[6]**

b) What is a lambda function? Explain with a suitable example. **[5]**

c) What are the good Python programming practices? **[4]**

OR

Q3) a) Explain the following types of function arguments with examples: **[6]**

i) Required arguments

ii) Keyword arguments

b) What do you mean by local and global variables? Explain it with example. **[5]**

c) Write a program to swap two numbers using a function. **[4]**

Q4) a) Explain the following string operations with suitable example. **[6]**

i) Concatenation

ii) Appending

iii) String repetition

b) Explain indexing and slicing operation on string with suitable example. **[5]**

c) Write a program to count the number of characters and words in the given string. **[4]**

s = "Welcome to the world of python programming"

OR

Q5) a) Explain following string methods with example. **[6]**

i) strip()

ii) index()

iii) isdigit()

b) What is a string? Explain with example iterating strings. **[5]**

c) Explain ord() and chr() functions with suitable examples. **[4]**

Q6) a) Explain any three programming paradigms. **[6]**

b) Define a class in Python. Explain_init_() method with suitable example. **[5]**

c) Explain the concept of a class and an object in OOP. **[4]**

OR

Q7) a) Explain the following features of Object Oriented Programming. **[6]**

i) Data encapsulation

ii) Data abstration

iii) Polymorphism

b) Explain class variables and object variable with suitable example. **[5]**

c) Write a program to create a class 'Employee' with two attributes. Display the details of two employees. **[4]**

Q8) a) What is a file? Explain different access modes for opening files. **[6]**

b) What is a dictionary? How to create, access and modify dictionary elements. **[5]**

c) Explain relative and absolute path of a file. **[4]**

OR

Q9) a) Explain any three methods for reading and writing files. **[6]**

b) Explain different directory methods with suitable examples. **[5]**

c) Write a program to read first 10 characters from the file and display it. **[4]**

□□□

Total No. of Questions : 8]

SEAT No. :

P6491

[Total No. of Pages : 7

[5868]-108
F.E. (All) (Semester I & II)
ENGINEERING MECHANICS (101011)
(2019 Pattern)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.*
2) *Figures to the right indicate full marks.*
3) *Assume suitable data, if necessary.*
4) *Use of electronic pocket calculator is allowed in the examination.*
5) *Use of cell phone is prohibited in the examination hall.*

Q1) a) A ball of weight W = 53.4 N rests in a right angled trough as shown in Fig. 1a. Determine the forces exerted on the sides of the trough at D & E. Assume all surfaces are perfectly smooth. **[6]**

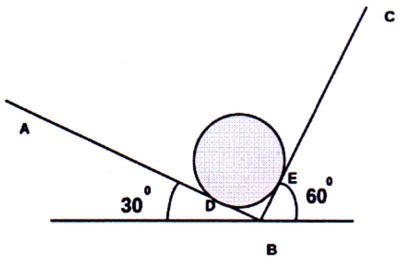

Fig. 1a

b) Three rods meeting at point A as shown in Fig. lb. Find magnitude of the tension developed in each rod AB, AC and AD. **[6]**

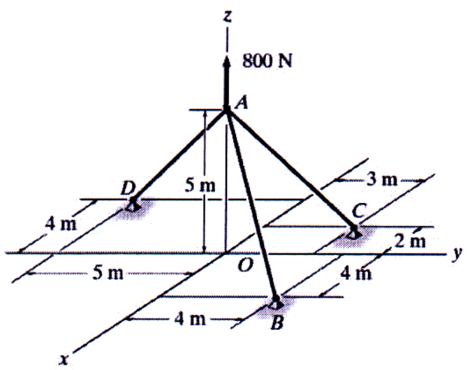

Fig. 1b

P.T.O.

c) Determine the support reaction of beam loaded and supported as shown in Fig.1c. **[6]**

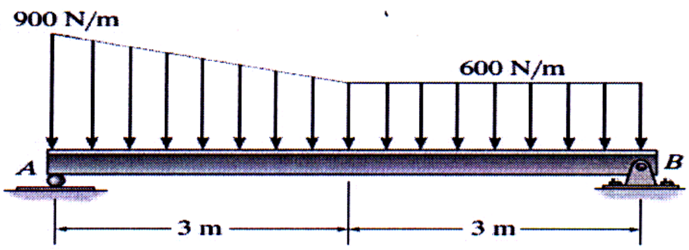

Fig. 1c

OR

Q2) a) A joist of length 4m and weighing 200N is raised by pulling a rope shown in Fig. 2a. Determine the tension T induced in the rope and reaction at end A of joist. **[6]**

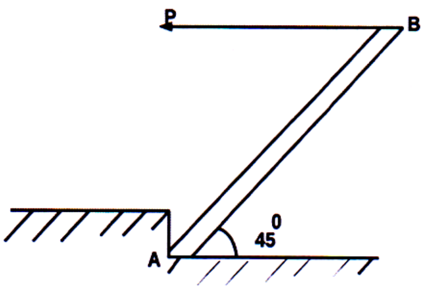

Fig. 2a

b) The rectangular 3m × 10m, steel plate subjected to four forces, as shown in Fig.2b. Determine the resultant force in magnitude and direction w.r.to 'O'. **[6]**

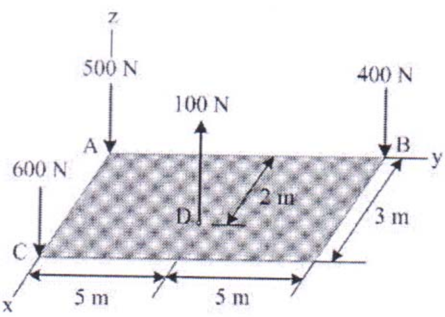

Fig. 2b

c) The I joist supports 20 kN and 40 kN on bean AB of span 7.5 m, as shown in Fig. 2c. Determine the support reactions at hinge B and roller D. **[6]**

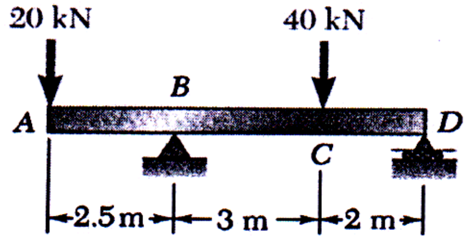

Fig. 2c

Q3) a) Determine the forces in all members of a truss loaded and supported as shown in Fig. 3a. **[6]**

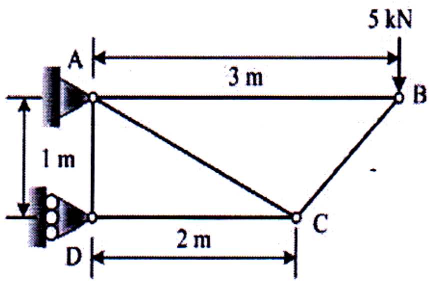

Fig. 3a

b) Cable ABCD is loaded and supported as shown in the Fig. 3b. If $d_c = 0.75$ m and $d_b = 1.125$ m, determine the component of reaction at A & maximum tension in the cable. **[5]**

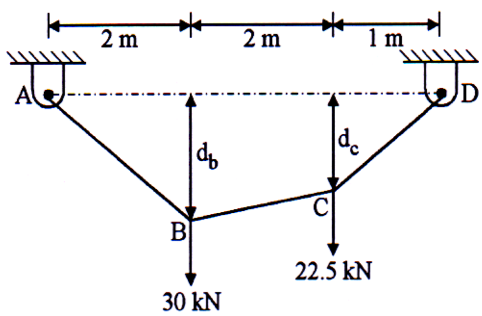

Fig. 3b

c) Determine the components of all forces acting on member ABE for the frame loaded with 2400N at D of the frame as shown in Fig. 3c. **[6]**

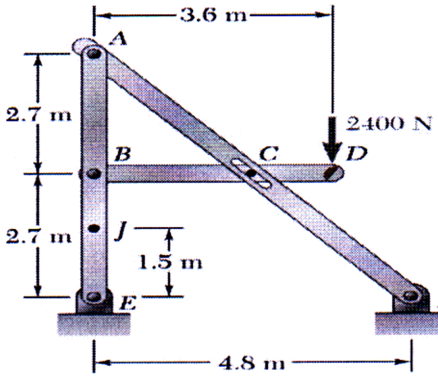

Fig. 3c

OR

Q4) a) Determine the forces in the members AB, AC and DC of the truss loaded and supported as shown in the Fig. 3a. Use method of section. **[6]**

b) Cable ABCDE supports two loads 6kN and 10 kN at B and C, as shown in Fig.4b. If the 'h_B'= 1.8 m, determine 'h_C' and reaction components at A and D. **[5]**

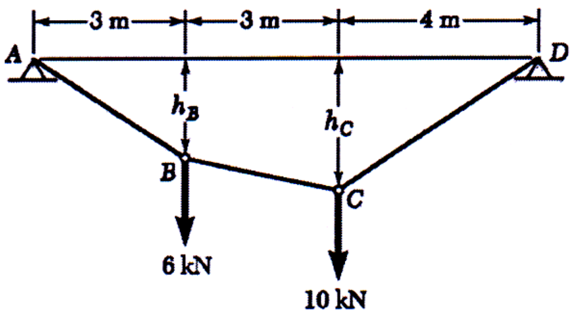

Fig. 4b

c) Determine the pin reactions at A, B and roller D for the frame members ABCand BD meeting at B as shown in Fig. 4c. **[6]**

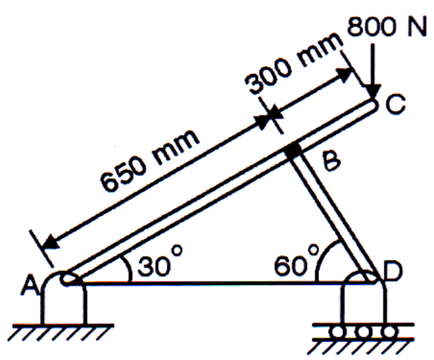

Fig. 4c

Q5) a) The acceleration of particle in rectilinear motion is given by $a = (3t^2+2)$. Initial velocity and displacements are 2m/s & 3m respectively. Find Position, velocity & acceleration of the particle at t = 2s. **[6]**

b) A projectile fired from the edge of a 150 m high cliff with an initial velocity of 180 m/s at an angle of elevation of 30° with the horizontal. Neglecting air resistance find : **[6]**

i) The greatest elevation above the ground reached by the projectile;

ii) Horizontal distance from the gun to the point, where the projectile strikes the ground

c) A car starts from rest and with constant acceleration achieves a velocity of 15 m/s when it travels a distance of 200 m. Determine the acceleration of the car and the time required to attain the velocity. **[6]**

OR

Q6) a) A ball is thrown vertically upward with an initial speed of 80m/s from the base of 50m high tower. Determine the distance 'h' by which the ball clear the top of tower. Also determine the time of travel when it reaches to base again. **[6]**

b) An outdoor track is 126 m in diameter. A runner increases her speed at a constant rate from 4.2 m/s to 7.2 m/s over a distance of 28.5 m. Determine the total acceleration of the runner 2s after she begins to increases her speed. **[6]**

c) A stone is dropped from the top of a tower 50 m high, At the same time another stone is thrown up from the foot of the tower with a velocity of 25 m/s. At what distance from the top & after how much time the two stones cross each other? **[6]**

Q7) a) A 30 kg block is dropped from a height of 2 m onto the 10 kg pan of a spring scale as shown in Fig. 7a. Assuming the impact to be perfectly plastic, determine the maximum deflection of the pan. The constant of the spring is k = 20 kN/m. **[6]**

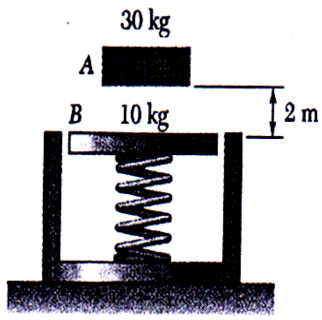

Fig. 7a

b) The bottle rests at a distance of 1 m from the center of the horizontal platform as shown in Fig. 7b. If the coefficient of static friction between the bottle and the platform is $\mu_s = 0.3$ determine the maximum speed that the bottle can attain before slipping. Assume the angular motion of the platform is slowly increasing. **[5]**

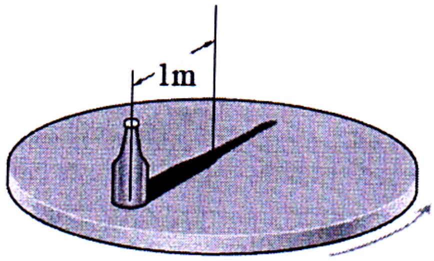

Fig. 7b

c) A ball is dropped from a height $h_0 = 2$ m on a smooth floor. Knowing that the height of the first bounce is $h_1 = 1.2$ m, determine (i) coefficient of restitution, and (ii) expected height h_2 after the second bounce. **[6]**

OR

Q8) a) Ball 'A' of 20 N and initial velocity 6 m/s rightwords collides with ball 'B' of 10 N and initial velocity 8 m/s leftwords before impact. If the coefficient of restitution is 'e' is 0.6, then determine the velocities of balls 'A' and 'B' after impact. **[5]**

b) Calculate the velocity v of the 50-kg crate, as shown in Fig. 8b, when it reaches the bottom of the chute at B, if it is given an initial velocity of 4 m/s down the chute at A. The coefficient of kinetic friction is 0.30. **[6]**

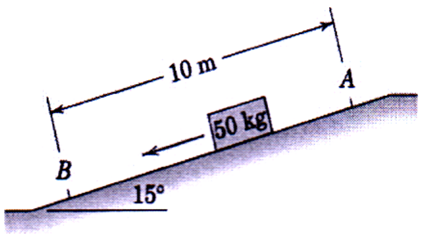

Fig. 8b

c) The 2kg pendulum bob 1.5m, is released from rest when it is at A as shown in Fig.8c. Determine the speed of the bob, using work energy principle, when it passes at a position 60 degrees down from A. **[6]**

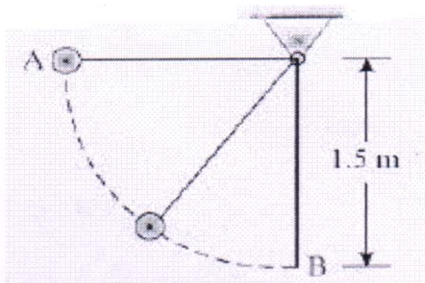

Fig. 8c

Total No. of Questions : 9]

SEAT No. :

P6492

[Total No. of Pages : 4

[5868]-109
First Year Engineering
ENGINEERING MATHEMATICS - II
(2019 Pattern) (Semester - I & III) (107008)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) *Q.No. 1 is compulsory.*
2) *Solve Q.2 or Q.3, Q.4 or Q.5, Q.6 or Q.7, Q.8, or Q.9.*
3) *Neat diagrams must be drawn whenever necessary.*
4) *Figures to the right indicate full marks.*
5) *Use of electronic pocket calculator is allowed.*
6) *Assume suitable data if necessary.*

Q1) Write the correct option for the following multiple choice questions.

a) $\int_0^{\frac{\pi}{2}} \cos^6 x =$ **[2]**

i) $\frac{5}{16}$ ii) $\frac{5\pi}{32}$

iii) $\frac{16\pi}{10}$ iv) $\frac{5\pi}{48}$

b) The curve $y^2(x-a) = x^2(2a-x)$ is **[2]**

i) Symmetric about X - axis and net passing through origin
ii) Symmetric about Y - axis and net passing through origin
iii) Symmetric about X - axis and passing through origin
iv) Symmetric about Y - axis and passing through origin

c) The value of double integral $\int_0^1\int_0^1 \frac{1}{\sqrt{1-x^2}\sqrt{1-y^2}}dx\,dy$ is **[2]**

i) $\frac{\pi}{2}$ ii) $\frac{\pi^2}{2}$

iii) $\frac{\pi^2}{4}$ iv) $\frac{\pi^2}{16}$

P.T.O.

d) The Centre (C) and radius (r) of the sphere $x^2+y^2+z^2-2y-4z-11=0$ are **[2]**

i) $C \equiv (0,1,2); r=4$ ii) $C \equiv (0,-1,-2); r=2$

iii) $C \equiv (0,2,4); r=4$ iv) $C \equiv (0,1,2); r=2$

e) The number of loops in the rose curve $r = a\cos 4\theta$ are **[1]**

i) 2 ii) 4

iii) 6 iv) 8

f) $\iint_R dxdy$ represents **[1]**

i) Volume ii) Centre of gravity

iii) Moment of inertia iv) Area of region R

Q2) a) If $I_n = \int_{\pi/4}^{\pi/2} \cot^n\theta\, d\theta$ prove that $I_n = \frac{1}{n-1} - I_{n-2}$. **[5]**

b) Show that $\int_0^1 x^{m-1}\left(1-x^2\right)^{n-1} dx = \frac{1}{2}\beta\left(\frac{m}{2}, n\right)$. **[5]**

c) Prove that $\int_0^1 \frac{x^a-1}{\log x}\, dx = \log(1+a), a \geq 0$. **[5]**

OR

Q3) a) If $I_n = \int_0^{\pi/2} x^n \sin x\, dx$ then prove that $I_n = n\left(\frac{\pi}{2}\right)^{n-1} - n(n-1)I_{n-2}$. **[5]**

b) Show that $\int_0^\infty e^{-h^2x^2} dx = \frac{\sqrt{\pi}}{2h}$. **[5]**

c) Show that **[5]**

$$\int_a^b e^{-x^2} dx = \frac{\sqrt{\pi}}{2}\left[erf(b) - erf(a)\right]$$

OR

Q4) a) Trace the curve $x^2y^2 = a^2\left(y^2 - x^2\right)$. **[5]**

b) Trace the curve $r = a(1-\sin\theta)$. **[5]**

c) Find the whole length of the loop of the curve $3y^2 = x(x-1)^2$. **[5]**

OR

Q5) a) Trace the curve $y^2(2a-x) = x^3$. **[5]**

b) Trace the curve $r = a\cos 2\theta$. **[5]**

c) Trace the curve $x^{2/3} + y^{2/3} = a^{2/3}$. **[5]**

Q6) a) Prove that the two spheres $x^2+y^2+z^2-2x+4y-4z=0$ and $x^2+y^2+z^2+10x+2z+10=0$ touch each other and find the co-ordinates of the point of contact. **[5]**

b) Find the equation of right circular cone whose vertex is $(1,-1,2)$, axis is the line $\frac{x-1}{2} = \frac{y+1}{1} = \frac{z-2}{-2}$ and the semi-vertical angle 45°. **[5]**

c) Find the equation of right circular cylinder of radius a whose axis passes through the origin and makes equal angles with the co-ordinate axes. **[5]**

OR

Q7) a) Show that the plane $x-2y-2z-7=0$ touches the sphere $x^2+y^2+z^2-10y-10z-31=0$. Also find the point of contact. **[5]**

b) Find the equation of right circular cone with vertex at origin, axis the $\mathrm{Y-axis}$ and semi-vertical angle 30°. **[5]**

c) Find the equation of right circular cylinder of radius $\sqrt{6}$ whose axis is the line $\frac{x}{1} = \frac{y}{-1} = \frac{z}{1}$. **[5]**

Q8) a) Change the order of integration and evaluate $\int_0^{\pi}\int_x^{\pi}\frac{\sin y}{y}\,dx\,dy$. **[5]**

b) Find the area of one loop of $r = a\sin 2\theta$. **[5]**

c) Find the moment of inertia of one loop of the lemniscate $r^2 = a^2\cos 2\theta$ about initial line. Given that $\rho = \frac{2m}{a^2}$, m is the mass of loop of lemniscate. **[5]**

OR

Q9) a) Evaluate $\iint_1 y\,dx\,dy$ over the region enclosed by the parabola $x^2 = y$, and the line $y = x + 2$. **[5]**

b) Evaluate $\iiint x^2 yz\,dx\,dy\,dz$, throughout the volume bounded by the plane $x = 0, y = 0, z = 0$ $\frac{x}{a}+\frac{y}{b}+\frac{z}{c}=1$. **[5]**

c) Find the y- coordinate of the centre of gravity of the area bounded by $r = a\sin\theta$ and $r = 2a\sin\theta$. Given that the area bounded by these curves is $\frac{3\pi a^2}{4}$. **[5]**

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Total No. of Questions : 8]

SEAT No. :

P6996

[Total No. of Pages : 3

[5868]-116
F.Y. Engineering (Semester - I & II)
ENGINEERING GRAPHICS
(2019 Pattern) (102012)

Time : 2½ Hours] *[Max. Marks : 50*

Instructions to the candidates:

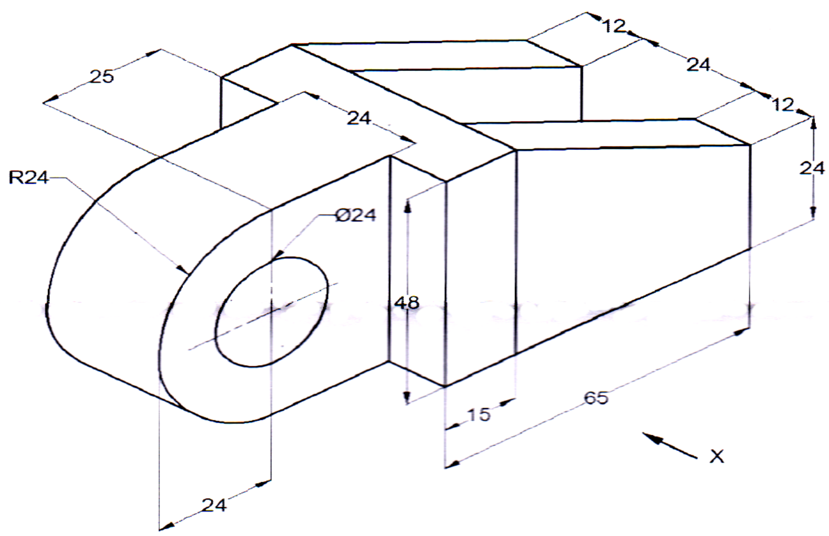
1) ***Solve Q1 or Q2, Q3 or Q4, Q5 or Q6 and Q7 or Q8.***
2) ***Assume suitable data, if necessary.***
3) ***Retail all the construction lines.***

Q1) Draw a curve traced out by a moving point in such a way that its distance from focus is 21 mm and eccentricity is $\frac{3}{5}$. **[8]**

OR

Q2) A straight rod AB of 60 mm length revolves one complete revolution with a uniform motion in a clockwise direction when hinged about A. During this period a point P moves along the rod from B to A and reaches back to B with a uniform linear motion. Draw the locus of point P. Name the Curve. **[8]**

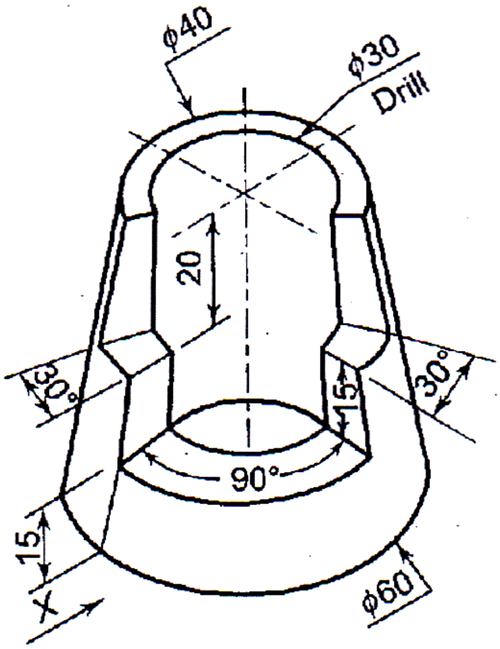
Q3) Figure shows a pictorial view of an object. By using first angle method of projection draw, Sectional Front View along symmetry looking in the direction of X. Top View and LHSV. Give dimensions in all views. **[16]**



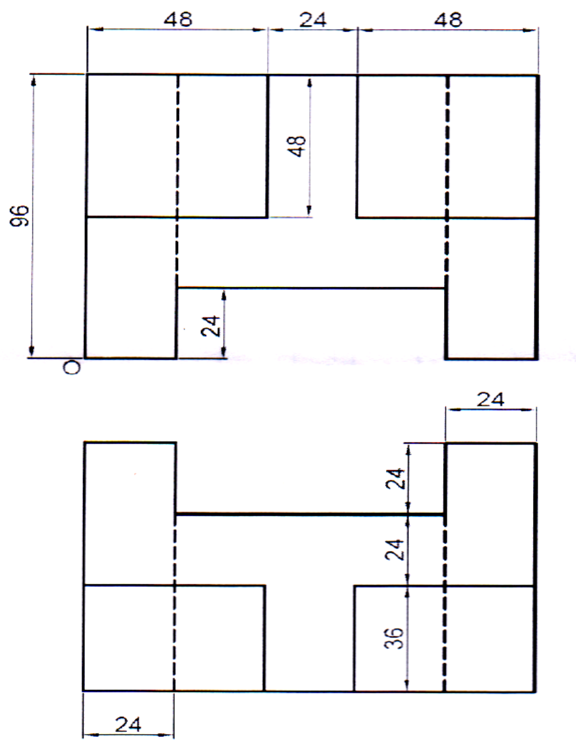
P.T.O.

OR

Q4) Figure shows a pictorial view of an object. By using first angle method of projection draw, Front View in the direction of X, Top View and RHSV. Give dimensions in all views. **[16]**

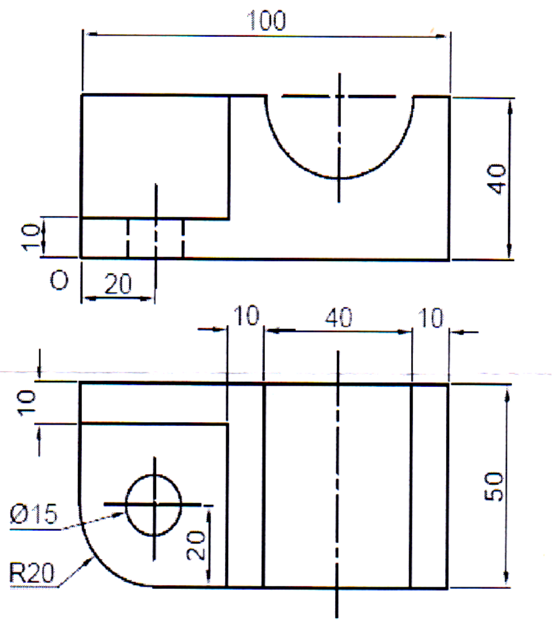


Q5) Figure show orthographic views of an object by first angle method of projection. Draw its isometric view and give all the dimensions. **[16]**



OR

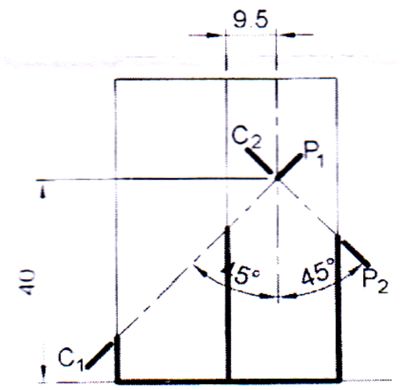
Q6) Figure show orthographic views of an object by first angle method of projection. Draw its isometric view and give all the dimensions. **[16]**



Q7) A square pyramid edge of the base 40 mm axis length 70 mm stands with its base on HP with two sides of the base parallel to VP. It is cut by an AIP inclined at 60° to the HP and passing through a point on the axis 40 mm from base. Draw the development of surfaces of pyramid. **[10]**

OR

Q8) Figure shows the FV of a square prism, base side 30 mm and axis 60 mm long, resting on its base on HP such that each of its base edges are equally inclined to VP. The prism is cut by two cutting planes C1-P1 and C2-P2 as shown in figure. Draw the development of remaining surface of square Prism. **[10]**



Total No. of Questions : 8]

SEAT No. :

P6493

[Total No. of Pages :3

[5868] - 120
F.E.
ENGINEERING MATHEMATICS - I
(2015 Pattern) (Semester - I & II) (Credit System) (107001)

Time : 2 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) *Attempt 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) *Use electronic pocket calculator is allowed.*

Q1) a) Reduce the following matrix in to normal form and hence find its rank.

$$\begin{bmatrix} 4 & 2 & -1 & 2 \\ 1 & -1 & 2 & 1 \\ 2 & 2 & -2 & 0 \end{bmatrix}$$ **[4]**

b) Find eigen values and eigen vector corresponds to lowest eigen value.

$$\begin{bmatrix} 3 & -1 & 1 \\ -1 & 5 & -1 \\ 1 & -1 & 3 \end{bmatrix}$$ **[4]**

c) A square lies above real axis in Argand diagram and two of its adjacent vertices are origin and the point $3+5i$. Find the complex numbers representing other two vertices. **[4]**

OR

Q2) a) Verify Cayley - Hamilton theorem for the matrix

$$A = \begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$$ hence find A^{-1}. **[4]**

b) Separate in to real and immaginary parts of $\cos^{-1}\left(\frac{3i}{4}\right)$. **[4]**

c) Solve $x^6-1=0$ using DeMoivre's theorem. **[4]**

P.T.O.

Q3) a) Solve any <u>ONE</u>. **[4]**

i) Test for convergence the series

$$\sum_{n=1}^{\infty}\frac{10n+4}{n^3}.$$

ii) Test for convergence the series

$$1-\frac{1}{2\sqrt{2}}+\frac{1}{3\sqrt{3}}-\frac{1}{4\sqrt{4}}+.........$$

b) Expand $e^x \cos x$ in ascending powers of x up to the term containing x^4. **[4]**

c) Find the n^{th} derivative of $y=\frac{x}{(x-1)^2}$. **[4]**

OR

Q4) a) Solve any <u>ONE</u>. **[4]**

i) Evaluate $\lim\limits_{x\to 0}\frac{\log\sin 2x}{\log\sin x}$.

ii) Evaluate $\lim\limits_{x\to 0}\left(\frac{a^x+b^x+c^x}{3}\right)^{\frac{1}{x}}$.

b) Using Taylor's theorem, expand $x^3 - 2x^2 + 3x + 1$ in ascending powers of $(x - 1)$. **[4]**

c) If $y = a\cos(\log x) + b\sin(\log x)$, prove that
$x^2 y_{n+2} + (2n+1)\, x\, y_{n+1} + (n^2 + 1)\, y_n = 0$. **[4]**

Q5) Solve any <u>TWO</u>.

a) Find the value of n for which $z=t^n e^{-r^2/4t}$ satisfies the partial differential equation $\frac{\partial z}{\partial r}=\frac{1}{r^2}\left[\frac{\partial}{\partial r}\left(r^2 z_r\right)\right]$. **[6]**

b) If $u=x^3 f\left(\frac{y}{x}\right)+\frac{1}{y^3}\phi\left(\frac{x}{y}\right)$ show that

$$x^2\frac{\partial^2 u}{\partial x^2}+2xy\frac{\partial^2 u}{\partial x\partial y}+y^2\frac{\partial^2 u}{\partial y^2}+x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=9u.$$ **[7]**

c) If $u = f(r, s)$ where $r = x^2 + y^2$, $s = x^2 - y^2$ show that $y\frac{\partial u}{\partial x} + x\frac{\partial u}{\partial y} = 4xy\frac{\partial u}{\partial r}$. **[6]**

OR

Q6) Solve any <u>TWO</u>.

a) If $u = 2x + 3y$, $v = 3x - 2y$ prove that $(u_x)_y \cdot (x_u)_v = (v_y)_x \cdot (y_v)_u$. **[6]**

b) If $u = \tan^{-1}\left(\frac{x^3 + y^3}{x + y}\right)$ show that

$$x^2\frac{\partial^2 u}{\partial x^2} + 2xy\frac{\partial^2 u}{\partial x \partial y} + y^2\frac{\partial^2 u}{\partial y^2} = \sin 2u[1 - 4\sin^2 u]$$ **[7]**

c) If $u = x^2 - y^2$, $v = 2xy$ and $z = f(u, v)$ show that

$$x\frac{\partial z}{\partial x} - y\frac{\partial z}{\partial y} = 2\left(\sqrt{u^2 + v^2}\right)z_u.$$ **[6]**

Q7) a) If $u^3 + v^3 = x + y$, $u^2 + v^2 = x^3 + y^3$ then show that

$$\frac{\partial(u,v)}{\partial(x,y)} = \frac{1}{2}\frac{y^2 - x^2}{uv(u - v)}$$ **[4]**

b) Determine whether the following functions are functionally dependent. If functionally dependent, Find the relation between them
$u = \sin x + \sin y$; $v = \sin(x + y)$. **[4]**

c) Find stationary values of the function $f(x, y) = x^3 + 3xy^2 - 3x^2 - 3y^2 + 7$, Also find the maximum value. **[5]**

OR

Q8) a) If $u + v^2 = x$, $v + w^2 = y$, $w + u^2 = z$, find $\left(\frac{\partial u}{\partial x}\right)$. **[4]**

b) If period of simple pendulum is $T = 2\pi\sqrt{\frac{l}{9}}$, Find the percentage error in T due to possible error upto 1% in l and 2.5% in g. **[4]**

c) Use Lagrange's method to find the maximum value of $u = x^2y^3z^4$, such that $2x + 3y + 4z = 9$. **[5]**

Total No. of Questions : 8]

SEAT No. :

P6494

[Total No. of Pages :2

[5868] - 121
F.E.
ENGINEERING CHEMISTRY
(2015 Pattern) (Semester - I & II) (Credit System) (107009)

Time : 2 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) ***Attempt 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) ***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.***

Q1) a) Explain with procedure, chemical rea^n & calculation for determination of total hardness of water sample by EDTA method. **[6]**

b) Explain conductometric titration curve in case of strong acid and weak base with chemical reaction. **[3]**

c) Define reference electrode. Draw neat labelled diagram of calomel electrode with cell representation. **[3]**

OR

Q2) a) Explain procedure, titration curve and reaction involved in potentiometric titration of Fe^{+2} Vs Ce^{+4}. Write the formulae for calculation of emf of the cell before and after equivalence point of titration. **[6]**

b) Write merits and demerits of greener and traditional synthesis of adipic acid. **[3]**

c) A zeolite softener was completely exhausted & regenerated by passing 80 litres of NaCl containing 150 gm/lit. of NaCl. How many litres of water sample containing hardness 600 ppm can be softened by this softener? **[3]**

Q3) a) Define glass transion temperature. Discuss any five factors affecting Tg value of polymer. **[6]**

b) What is biodiesel? Write its advantages and disadvantages. **[3]**

c) 0.5 gm of coal sample on complete combustion was found to increase the weight of U-tube containing $CaCl_2$ by 0.25 gm & U-tube containing KOH by 1.3 gm. calculate % of carbon & hydrogen in coal sample. **[3]**

OR

Q4) a) Explain Bomb calorimeter with principle, construction, working and neat labelled diagram. State formula to calculate GCV. **[6]**

b) Distinguish bet^{n} Natural Rubber and vulcanised Rubber. **[3]**

c) Define the following terms with suitable example. **[3]**

i) Polymer

ii) Monomer

iii) Functionality of Monomer

Q5) a) Explain production of hydrogen by steam reforming of methane & coke. **[6]**

b) Explain isotopes of carbon with applications. **[4]**

c) Differentiate between Diamond & Graphite. **[3]**

OR

Q6) a) What are carbon nanotubes (CNTs)? Give their types with any four applications. **[6]**

b) Give any four methods of storage of hydrogen. **[4]**

c) Write structure, synthesis and applications of Silane. **[3]**

Q7) a) Discuss electrochemical corrosion by hydrogen liberation and oxygen absorption mechanism. **[6]**

b) What is principle of cathodic protection? Explain it with any one method. **[4]**

c) State Pilling-Bedworth ratio. Give its significance with suitable example. **[3]**

OR

Q8) a) Explain any six factors affecting corrosion. **[6]**

b) State the principle of electroplating. Explain it with diagram & reaction involved. **[4]**

c) Explain galvanisation with neat labelled diagram. **[3]**

Total No. of Questions : 8]

SEAT No. :

P6495

[Total No. of Pages :2

[5868] - 122
F.E.
ENGINEERING PHYSICS
(2015 Credit Pattern) (Semester - I & II) (107002)

Time : 2 Hours] ***[Max. Marks : 50***

Instructions to the candidates:

1) ***Neat diagrams must be drawn wherever necessary.***
2) ***Figures to the right side indicate full marks.***
3) ***Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.***
4) ***Assume suitable data if necessary.***

Constants:

1) ***$h = 6.63 \times 10^{-34}$ J-S = Planck's constant.***
2) ***$e = 1.6 \times 10^{-19}$ C = electronic charge.***
3) ***$c = 3 \times 10^{8}$ m/s = velocity of light.***
4) ***$me = 9.1 \times 10^{-31}$kg = mass of electron***

Q1) a) Explain formation of Newton's rings prove that in Newton's rings by refiected light the diameter of bright ring are proportional to the square root of odd natural number. **[6]**

b) A plane transmission grating has 5000 lines/cm. Find out highest order of spectrum observed it incident light $\lambda = 6000$ A°. **[3]**

c) Find the echo time of ultrasonic pulse which is travelling with the velocity 1500 m/s in mild steel. The correct thickness measured by gauss meter is 525m. **[3]**

OR

Q2) a) What is reverberation? Give sabine formula for reverberation time.What are the factors affecting reverberation time? Explain how it can be optimized by controlling these factors. **[6]**

b) Calculate the natural frequency of vibrations for a quartz plate of thickness 5.5mm ($Y = 8 \times 10^{10}$ N/M^2 and $\rho = 2650$ kg/m^3) **[3]**

c) Explain with a suitable diagram how the principle of interference is used to test optical flatness of surface. **[3]**

P.T.O.

Q3) a) Explain construction and working of He-Ne laser. **[6]**

b) What is Fermi energy level? Write the formula for the Fermi Dirac probability distribution function. **[3]**

c) Write four applications of solar cell. **[3]**

OR

Q4) a) What is photovoltaic effect Explain the construction and working of solar cell. Also I-V characteristics of solar cell and define fill factor. **[6]**

b) Calculate the number of accepters to be added in germanium sample to obtain the resistivity of 100 ohm-cm (Given μ_h = 1700 cm^2/V-Sec). **[3]**

c) What is difference between normal photography and holography? Which principle is most useful to record hologram? **[3]**

Q5) a) State and explain Heisenberg uncertainty principle illustrate it by an experiment of diffraction at single slit. **[6]**

b) State De-Broglie hypothesis of matter waves. Derive the expression for matter waves for an accelerating particle in terms of kinetic energy. **[4]**

c) Calculate the wavelength associated with 1 MeV proton? **[3]**

OR

Q6) a) Derive schrödinger time independent wave equation. **[6]**

b) Explain wave function. Give the physical significance of ψ^2. **[4]**

c) An electron is bound by potential which closely approaches an infinite square well of width 2.5 A°. Calculate the lowest three permissible energies (in electron volts) the electron can have. **[3]**

Q7) a) Explain the phenomenon of super conductivity. Explain Type - I and Type - II super conducters. **[6]**

b) Explain the synthesis of metal nanoparticle by colloidal route method. **[4]**

c) Critical temperature of superconducter with isotopic mass = 200 is 5°K. Calculate the critical temperature of the superconducters when isotopic Mass = 196. **[3]**

OR

Q8) a) Explain any two properties of nanoparticles. **[6]**

b) State and explain Meissner effect. **[4]**

c) Explain any three applications in Nanotechnology. **[3]**

Total No. of Questions : 8]

SEAT No. :

P6496

[Total No. of Pages :2

[5868] - 123
F.E.
BASIC ELECTRONICS ENGINEERING
(2015 Pattern) (Semester - I & II) (104012) (Credit System)

Time : 2 Hours] ***[Max. Marks : 50***

Instructions to the candidates:

1) ***Attempt Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Figures to the right side indicate full marks.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Assume suitable data if necessary.***

Q1) a) Draw the output characteristic of BJI in CE configuration. Indicate all three regions of operation with application of each region. **[6]**

b) Compare performance of HWR center tapped FWR and Bridge Rectifier. **[6]**

OR

Q2) a) Describe Zener Diode as Voltage Regulator with suitable diagram. **[6]**

b) Draw and explain Drain & transfer characteristic of N-channel MOSFET. **[6]**

Q3) a) Draw the circuit diagram of IC 555 as an Astable Multivibrator and explain it. Give the output frequency formula. **[6]**

b) Draw the schematic diagram and explain working of 4:1 MUX and 1:4 DEMUX. **[6]**

OR

Q4) a) Explain OP-AMP as differentiator with ckt diagram. **[6]**

b) Implement full adder using gates, truth table and give expression for SUM and CARRY. **[6]**

Q5) a) Classify Transducers. Compare Active and Passive Transducers. **[6]**

b) Draw the constructional diagram of SCR and explain its operation with characteristic. **[7]**

OR

Q6) a) Explain with a neat diagram the construction and working of LVDT. **[7]**

b) Compare SCR and TRIAC. **[6]**

Q7) a) What is need of Modulation. Draw and explain block diagram of AM. **[7]**

b) Explain the working principle of OFC with suitable diagram. Give its advantages and applications. **[6]**

OR

Q8) a) Explain communication system with proper diagram and explain each block. **[6]**

b) Draw and explain FM modulation technique. Give its modulation index. **[7]**

Total No. of Questions : 8]

SEAT No. :

P6497

[Total No. of Pages :3

[5868] - 124

F.E. (All Branches)

BASIC ELECTRICAL ENGINEERING

(2015 Pattern) (Semester - I & II) (103004)

Time : 2 Hours] ***[Max. Marks : 50***

Instructions to the candidates:

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) ***Use of Non-Programmable Scientific Calculators is allowed.***
5) ***Assume suitable data if necessary.***

Q1) a) Distinguish between statically (mutually) and dynamically induced emf. **[6]**

b) A resistance element having cross-sectional area of $25mm^2$ and length of 10m takes a current of 4 amps from 230V supply at temperature of 20°C. Find:

i) Resistivity of the material and

ii) Current it will take when temp. rises to 80°C. Assume $\alpha_{20} = 0.0003/°C$. **[6]**

OR

Q2) a) If α_1 and α_2 are RTC's of material at t_1 °C & t_2 °C respectively, then prove that $\alpha_1 - \alpha_2 = \alpha_1 \alpha_2 (t_2 - t_1)$. **[6]**

b) Two coils have a mutual inductance of 0.3 H. If the current in first coil is varied from 5 A to 2A in 0.4 sec. Calculate: **[6]**

i) The average emf induced in the second coil and

ii) Rate of change of flux linked with the second coil having 200 turns.

Q3) a) Drive an emf equation for a single phase transformer. **[6]**

b) Derive an expression of RMS value of the sinusoidal varying current, in terms of peak value. **[7]**

OR

Q4) a) Compare core type and shell type 1-ph transformer. **[6]**

b) The instantaneous values of two emfs are $e_1 = 30 \sin(\omega t)$ volts and $e_2 = 20 \sin(\omega t - \pi/4)$ volts. Find the expression for the instantaneous value of **[7]**

i) $e_1 + e_2$ and

ii) $e_1 - e_2$

Q5) a) Derive the expression for power, when voltage $v = V_m \sin \omega t$ is applied across R-L series circuit. Draw the circuit diagram and phasor diagram. **[6]**

b) Two impedances $Z_1 = 5 + j7\ \Omega$ and $Z_2 = 10 - j5\ \Omega$ are connected in parallel across 200V, 50 Hz ac supply. Determine

i) Branch currents

ii) Power consumed by each branch and

iii) Total power of the circuit **[7]**

OR

Q6) a) An inductor of 0.0127 H is connected in series with a resistor of 3Ω across an AC supply which is given by $v = 141.42 \sin(100\pi t)$ volts. Calculate

i) Inductive reactance, Impedance

ii) RMS value of current flowing in the circuit.

iii) Write the expression for the instantaneous current

iv) Determine the power factor **[6]**

b) Derive the relationship between the phase values and line values of current and voltage, for a balanced three phase star connected inductive load across three phase supply. Draw the circuit diagram and phasor diagram. Assume phase sequence RYB. **[7]**

Q7) a) Derive formula to convert DELTA connected resistive network into its STAR connected equivalent circuit. **[6]**

b) Determine the current through 6Ω resistor connected across AB in the circuit of Fig. 7(b) by using Thevenin's theorem. **[6]**

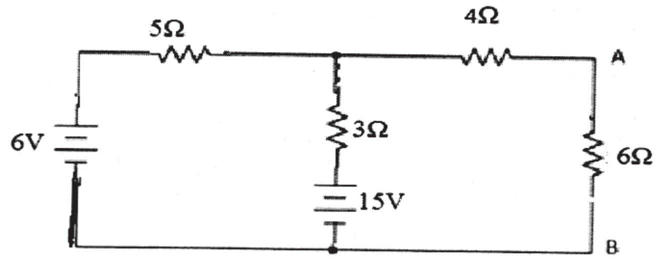


Fig 7 (b)

OR

Q8) a) State and explain Kirchhoff's Laws. **[6]**

b) Find current flowing through 4Ω using Kirchhoff's loop analysis for the network shown in Q7(b). **[6]**

Total No. of Questions : 8]

SEAT No. :

P6498 **[5868] - 125** [Total No. of Pages : 2

F.E.

BASIC CIVIL & ENVIRONMENTAL ENGINEERING

(2015 Pattern) (101005) (Semester - I & II)

Time : 2 Hours] *[Max. Marks :* 50

Instructions to the candidates:

1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
2) *Neat diagrams must be drawn whenever necessary.*
3) *Figures to the right indicate full marks.*

Q1) a) Write a note on various types of loads on a structure. **[4]**

b) Explain in brief the practical application of Structural Engineering. **[4]**

c) Write a brief note on recycling of materials in construction industry. **[4]**

OR

Q2) a) What is Precast concrete? State any two application. **[4]**

b) Define Transportation Engineering. Highlight the importance of Transportation Engineering in today's era. **[4]**

c) How will you correlate the importance of Environmental Engineering and development activities? Explain. **[4]**

Q3) a) The following readings were taken on a continuously sloping ground with a dumpy level and 4 m leveling staff. The readings are 1.0, 2.0, 1.0, 2.0, 3.0. Rule out a field book page and find R.L.'s of staff stations using collimation plane method, if the R.L. of first staff station is 500,000 m above MSL. Apply usual checks. **[6]**

b) Comment on the statement 'In coming future the disposal of e-waste would be the biggest problem'. **[4]**

c) Enlist any four natural resources. Explain the necessity of conserving natural resources. **[3]**

OR

P.T.O.

Q4) a) Define contour, state its uses and characteristics. **[5]**

b) What is solid waste management? Explain steps involved in it. **[4]**

c) State various factors to be considered by engineers for sustainable development. **[4]**

Q5) a) What is prospect? Draw sketches to show how prospect can be achieved. **[4]**

b) State and explain any 4 guidelines used for achieving green building. **[5]**

c) State briefly the planning principle 'Sanitation". **[4]**

OR

Q6) a) A plot owner himself proposed G+1 construction with 150 sq.m construction on each floor on a plot of 14 × 19m. find ground coverage and F.S.I. proposed. If margins from all sides are 2 m and F.S.I. = 1 are must as per byelaws, state the reasons whether plan will be sanctioned or not. **[5]**

b) Write a note on necessity of bye-laws. **[4]**

c) How do you maintain Privacy of building? What are the various ways of achieving it. **[4]**

Q7) a) Explain four causes and sources of Air Pollution. **[4]**

b) Briefly explain various uses of solar energy in Indian context. **[4]**

c) Explain in brief the control of Noise Pollution. **[4]**

OR

Q8) a) Write a short note on Acid Rain. **[4]**

b) Write short note on Geothermal energy. **[4]**

c) Explain with sketches working of a biogas plant. **[4]**

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Total No. of Questions : 8]

SEAT No. :

P6499

[5868] - 126

[Total No. of Pages : 3

F.E.

ENGINEERING GRAPHICS-I

(2015 Pattern) (Semester - I & II) (102006)

Time : 2 Hours] ***[Max. Marks : 50***

Instructions to the candidates:

1) ***Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Use only half imperial size drawing sheet as answer book.***
3) ***Retain all construction lines.***
4) ***Assume suitable data if necessary.***

Q1) The point 'A' of 65 mm long Line 'AB' is in HP and 15 mm in front of VP. The line is inclined to HP and VP at 40° and 35° respectively. Draw the projections of line AB and locate its traces. **[12]**

OR

Q2) An isosceles triangle, base 50 mm and altitude 80 mm, is resting in VP on its base. Its surface is inclined to VP so that the corner opposite to resting side is 50 mm in front of VP. Draw the projections if its resting side is inclined to HP at an angle of 45°. Find inclinations made by the plane with HP and VP. **[12]**

Q3) A triangular prism side of base 30mm and axis height 50mm is kept on HP on edge of its base in such a way that its axis makes 45° with HP. Draw the projections of prism when longer edge opposite to base edge on HP is inclined at 30° with the VP. **[13]**

OR

Q4) a) Draw an Archimedean spiral for one convolution given that Diameter is 120 mm. **[7]**

b) Draw the development of lateral surface of hexagonal prism of base side 23 mm and axis height 69 mm. **[6]**

Q5) Figure 1 shows a pictorial view of an objects. By using first angle method of projections, draw; **[13]**

i) front view in the direction X **[4]**

ii) Left hand side view **[4]**

iii) Top view **[4]**

iv) Overall Dimensions **[1]**

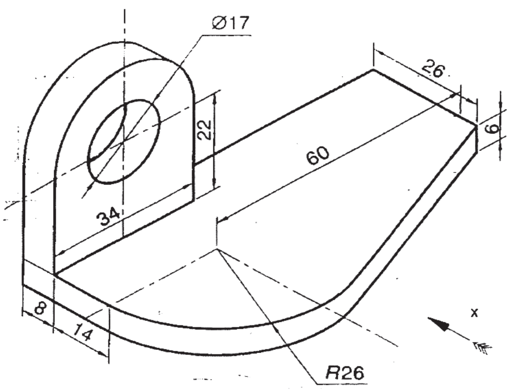

Figure 1

OR

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

i) Sectional front view, along symmetry of the objects **[4]**

ii) Right hand side view **[4]**

iii) Top view **[4]**

iv) Dimensions **[1]**

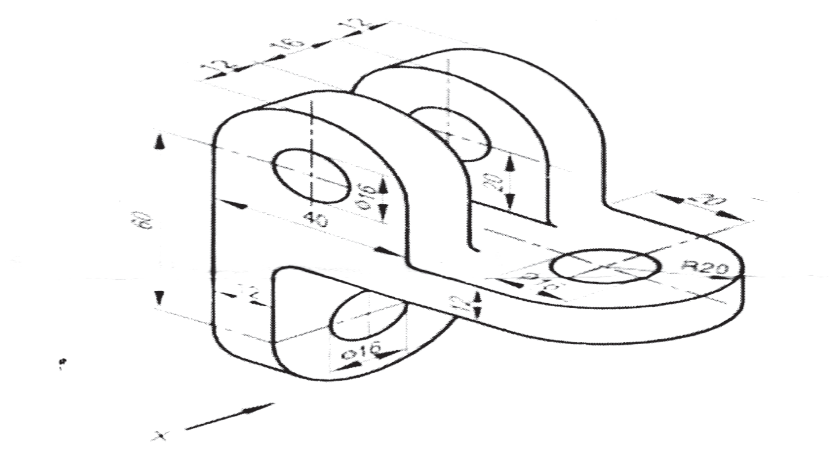

Figure 2

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

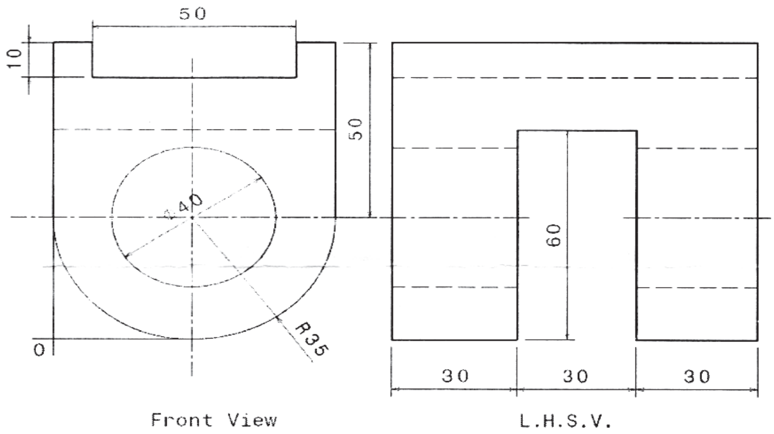

Figure 3

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

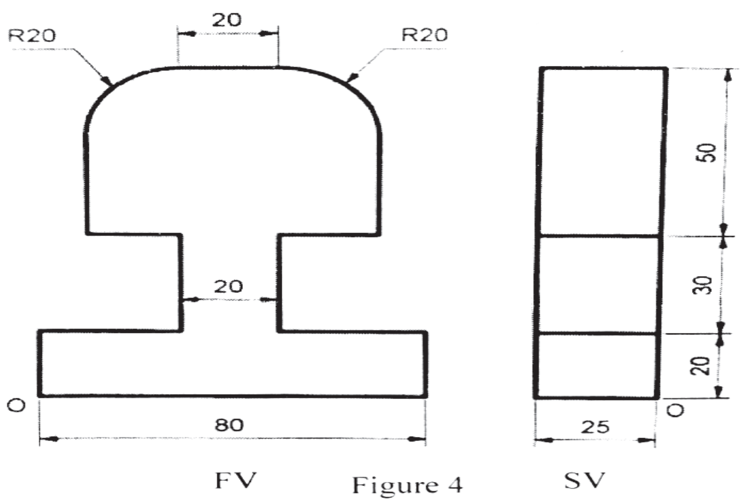

Figure 4

☆☆☆

Total No. of Questions : 8]

SEAT No. :

P6500

[Total No. of Pages : 4

[5868]-127

F.E.

ENGINEERING MATHEMATICS - II

(Credit System) (2015 Pattern) (Semester - I & II) (107008)

Time : 2 Hours] ***[Max. Marks : 50***

Instructions to the candidates:

1) ***Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.***
2) ***Neat diagram must be drawn whenever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Use of electronic pocket calculator allowed.***
5) ***Assume suitable data, if necessary.***

Q1) a) Solve the following differential Equations.

i) $x\cos x\cos y+\sin y\dfrac{dy}{dx}=0$ **[4]**

ii) $\cos y-x\sin y\dfrac{dy}{dx}=\sec^2 x$ **[4]**

b) When a switch is closed in a circuit containing a battery E, a resistance R and an inductance L, the current i build up at a rate given by $\mathrm{L}\dfrac{di}{dt}+\mathrm{R}i=\mathrm{E}$. Find i as a function of t. How long will it be, before the current has reached 90% of it's maximum value, if E = 6 volts, R = 100 ohms & L = 0.1 henry? **[4]**

OR

Q2) a) Solve $\left(1+y^2\right)+\left(x-e^{-\tan^{-1}y}\right)\dfrac{dy}{dx}=0$ **[4]**

P.T.O.

b) Solve the following:

i) If the temperature of surrounding is 25°C and the body cools from 100°C to 75°C in one minute. What will be its temperature at the end of 3 minutes? **[4]**

ii) A steam pipe 20 cm in diameter is protected with a covering 6cm thick for which the coefficient of thermal conductivity is k = 0.0003 cal/cm deg. sec. steady state. Find the heat lost per hour through a meter length of the pipe, if the surface of the pipe is at 200°C and the outer surface of the covering is at 30°C. **[4]**

Q3) a) Find the half range sine series of the function $f(x) = x - x^2$, in the interval (0,1). **[5]**

b) Show that $\int_0^\infty \frac{x^8(1-x^6)}{(1+x)^{24}} dx = 0$ **[3]**

c) Solve any one: **[4]**

i) Trace the curve $y^2(2a-x) = x^3$

ii) Trace the curve $x = a\cos^3 t, y = a\sin^3 t$

OR

Q4) a) Find the length of the cardioid $r = a(1+\cos\theta)$. **[4]**

b) If $y = \int_0^x f(t)\sin a(x-t)\,dt$, show that $\frac{d^2y}{dx^2} + a^2y = af(x)$. **[4]**

c) If $I_n = \int_0^{\pi/4} \frac{\sin(2n-1)x}{\sin x} dx$, then prove that, $n(I_{n+1} - I_n) = \sin\left(\frac{n\pi}{2}\right)$, and hence find I_3. **[4]**

Q5) a) Find the equation of the sphere which passes through the point $A(-1,0,0)$ and touches the plane $2x-y-2z-4=0$ at the point $B(1,2,-2)$. **[5]**

b) Find the equation of right circular cone with vertex at (0, 3, 0), axis as $y-$axis and equation of one of the generators of cone is $x=y=z$. **[4]**

c) The axis of the right circular cylinder of radius 2 is $\frac{x-1}{2}=\frac{y}{3}=\frac{z-3}{1}$. Find its equation. **[4]**

OR

Q6) a) Find the equation of the sphere through the circle $x^2+y^2+z^2=1$, $2x+3y+4z=5$ and which intersects the sphere $x^2+y^2+z^2+3x-3y+3z-56=0$ orthogonally. **[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°. **[4]**

c) Find the equation of the right circular cylinder of radius 1 whose axis is the line $\frac{x-2}{2}=\frac{y-1}{1}=\frac{z}{3}$. **[4]**

Q7) Attempt any Two:

a) Find the area bounded by $y^2=4x$ and $y=x-8$. **[6]**

b) Evaluate $\int_0^\infty dx\int_0^\infty dy\int_0^\infty \frac{dz}{\left(1+x^2+y^2+z^2\right)^2}$. **[7]**

c) Find the moment of inertia of the area enclosed by $r=a(1+\sin\theta)$ about the line $\theta=0$. **[6]**

OR

Q8) Attempt any Two:

a) By transforming to polar form evaluate $\iint_R \frac{x^2y^2}{\left(x^2+y^2\right)}\,dx\,dy$ where R is annulus between $x^2+y^2=4,\ x^2+y^2=9.$ **[6]**

b) Evaluate $\iiint xyz\ dxdydz$ over the tetrahedron formed by $x=0, y=0, z=0$ and $x+y+z=1.$ **[7]**

c) Find the centre of gravity of one loop of $r=a\cos 2\theta.$ **[6]**

Total No. of Questions : 6]

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P7255

[Total No. of Pages : 5

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F.E.
ENGINEERING MECHANICS
(2015 Pattern) (Semester - I & II) (101011)

Time : 2 Hours] *[Max. Marks : 50*

Instructions to the candidates :

1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6.*
2) *Figures to the right indicate full marks.*
3) *Assume suitable data, if necessary.*
4) *Use of electronic pocket calculator is allowed in the examination.*
5) *Use of cell phone is prohibited in the examination hall.*

Q1) a) Determine the resultant of all the three forces 200 N, 250 N and 400 N, acting at 'O' on the bracket as shown in **Fig. 1a.** **[4]**

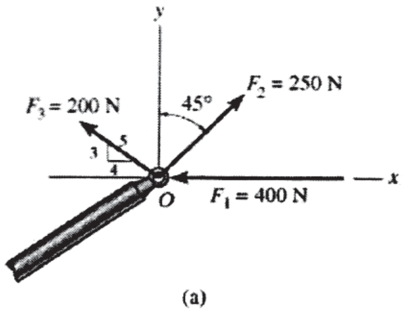

Fig. 1a

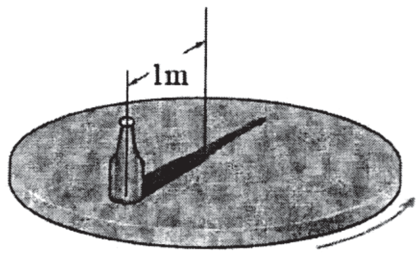

Fig. 2b

b) The bottle rests at a distance of 1 m from the center of the horizontal platform as shown in **Fig. 2b.** If the coefficient of static friction between the bottle and the platform is $\mu_s = 0.3$ determine the maximum speed that the bottle can attain before slipping. Assume the angular motion of the platform is slowly increasing. **[4]**

c) The acceleration of a particle as it moves along a straight line is given by $a = (2t - 1)$ m/s^2, where t is in seconds. If $s = 1$ m and $v = 2$ m/s when $t = 0$, determine the particle velocity and position when $t = 6$ s. **[4]**

d) A tennis ball dropped from a height 1800 mm and it rebounds back to a height of 1100 mm. Determine the coefficient of restitution. **[4]**

P.T.O.

OR

Q2) a) Determine the position of centroid of the shaded area with respect to origin 'O' as shown in **Fig. 2a.** **[4]**

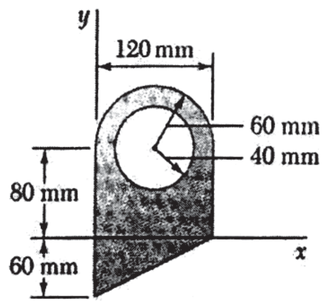

Fig. 2

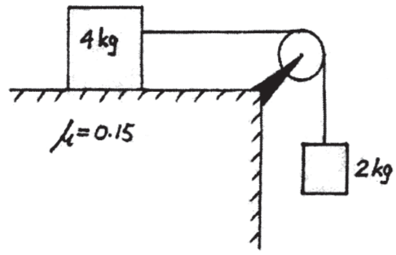

Fig. 2b

b) The system as shown in **Fig. 2b,** 4 kg block resting on the horizontal floor with coefficient of friction as 0.15, connected with 2 kg block by a inextensible cable which is passing over a frictionless pulley, initially is at rest. Neglecting mass of the pulley, determine the acceleration of the 2 kg block. **[4]**

c) A projectile fired from the edge of a 150 m high cliff with an initial velocity of 180 m/s at an angle of elevation of 30° with the horizontal.**[4]**

Neglecting air resistance find :

i) The greatest elevation above the ground reached by the projectile;

ii) Horizontal distance from the gun to the point, where the projectile strikes the ground.

d) A ball has a mass of 20 kg is thrown upward with a speed of 25 m/s. Determine the time and distance travelled by the ball before stopping. Use impulse momentum principle. **[4]**

Q3) a) The I joist supports 20 kN and 40 kN on bean AB of span 7.5 m, as shown in **Fig. 3a.** Determine the support reactions at hinge B and roller D. **[5]**

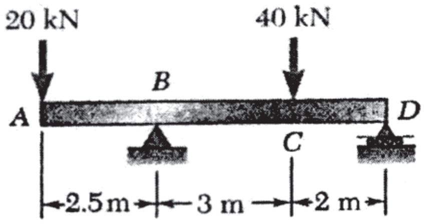

Fig. 3a

b) A cylinder of 2.5 kN is resting in a trough as shown in **Fig. 3b.** Determine the normal reactions at A and B. **[6]**

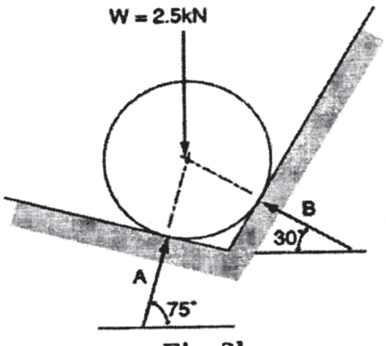

Fig. 3b

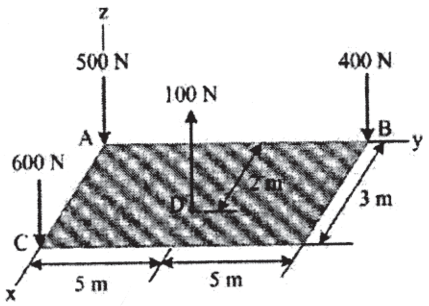

Fig. 3c

c) The rectangular 3m × 10m, steel plate subjected to four forces, as shown in **Fig. 3c.** Determine the resultant force in magnitude and direction w.r.to 'O'. **[6]**

OR

Q4) a) Determine the horizontal and vertical components of force that pins A and B exert on the frame as shown in **Fig. 4a.** **[6]**

b) Three rods meeting at point A as shown in **Fig. 4b.** Find magnitude of the tension developed in each rod AB, AC and AD. **[6]**

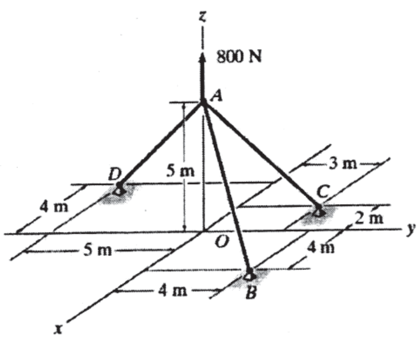

Fig. 4b

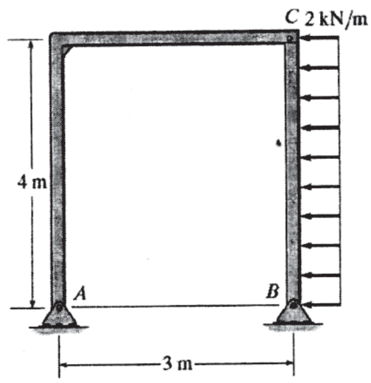

Fig. 4a

c) The I joist supports 4 kN as shown in **Fig. 4c.** Determine the support reactions at hinge A and roller B, if the self weight of the joist is 2 kN/m. **[5]**

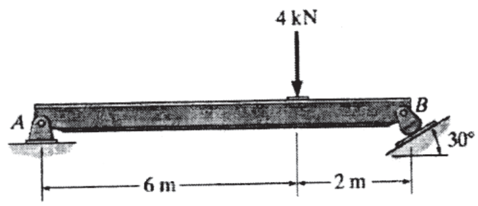

Fig. 4c

Q5) a) A ladder 5 meters long rests on a horizontal ground and leans against a smooth vertical wall at an angle 70° with the horizontal. The weight of the ladder is 900 N and acts at its middle. The ladder is at the point of sliding, when a man weighing 750N stands on a rung 1.5 meter from the bottom of the ladder. Calculate the coefficient of friction between the ladder and the floor. **[6]**

b) Determine the forces in all the members of the truss loaded and supported as shown in the **Fig. 5b**. Tabulate the result with magnitude and nature of force in the members. **[6]**

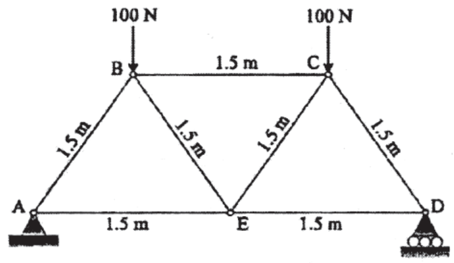

Fig. 5b

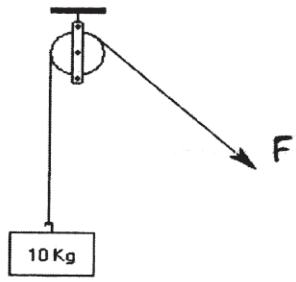

Fig. 5c

c) A block of 10kg hanging through a frictionless cable and kept at rest by applying a force of 'F' N on other side of the cable, which is passing through the pulley as shown in the **Fig. 5c**. Determine the range of force required 'F' required to keep the block in rest, if the lap angle between cable and pulley is 125 degrees. (Take $\mu = 0.15$). **[5]**

OR

Q6) a) Cable ABCD is loaded and supported as shown in the **Fig. 6a.** If $d_c = 0.75$ m, determine the component of reaction at A & maximum tension in the cable. **[6]**

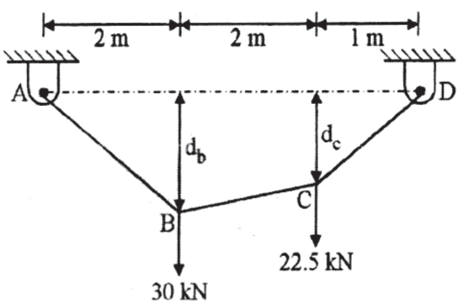

Fig. 6a

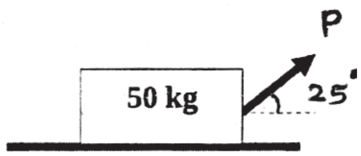

Fig. 6b

b) A 50 kg block resting on rough horizontal floor with coefficient of friction between floor and block as 0.25, applied with force P inclined upward at an angle 25 degrees with horizontal. Determine the magnitude of the force required just to start the motion of the block. Refer **Fig. 6b**. **[6]**

c) Determine the forces in the members BC, BE and AE of the truss loaded and supported as shown in the **Fig.5b,** using section method. Tabulate the result with magnitude and nature of force in the members. **[5]**

▽▽▽▽

Total No. of Questions : 8]

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P6501

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[Total No. of Pages : 2

F.E. (Common)
BASIC MECHANICAL ENGINEERING
(2015 Pattern) (Semester I & II) (102013)

Time : 2 Hours] *[Max. Marks :* 50

Instructions to the candidates:

1) *Neat diagrams must be drawn whenever necessary.*
2) *Figures to right indicate full marks.*
3) *Assume suitable data, if necessary.*
4) *Use of non-programmable electronic calculator is permitted.*
5) *Attempt four questions of eight : Q.No. 1 or Q.No. 2, Q.No. 3 or Q.No.4, QNo.5 or Q.No.6 Q.No.7 or Q.No8.*

Q1) a) What is machine design? Explain various steps involved in design process. **[6]**

b) How bearings are classified? Explain, with neat sketch, Ball Bearing. **[6]**

OR

Q2) a) Explain working of disc brake with neat sketch. **[6]**

b) Compare belt drive, chain drive and gear drive. **[6]**

Q3) a) With neat sketch, explain electric arc welding. **[7]**

b) Explain Turning and Facing operation performed on lathe machine. **[6]**

OR

Q4) a) Explain tapping, Reaming, countersingking operations performed on drilling machine. **[6]**

b) With neat sketch, explain forging process with its advantages and applications. **[7]**

Q5) a) Explain following terms: **[4]**

i) Zeroth law of thermodynamics

ii) Closed system

P.T.O.

b) Define and explain, atmospheric pressure, gauge pressure, absolute pressure and unit of pressure. **[4]**

c) A heat pump is used to maintain the house at 24°C, the house is losing the heat at the rate of 1800 kJ/min to the surrounding. If the heat pump is driven by an electric motor of power rating 12kW, find: **[5]**

i) The amount of heat absorbed from the surrounding

ii) The COP of heat pump

Draw the sketch of system

OR

Q6) a) Explain "Kelvin Plank and Clausius" statement of secod law of thermodynamics. **[4]**

b) Prove that : (COP) heat pump = 1+ (COP) Refrigerator **[4]**

c) A U-tube manometer connected to pipe carrying oil, shows reading of 40cm of mercury. Find the absolute pressure of oil in the pipe, if barometer reading is 10m of water. Assume: density of mercury is 13600kg/m^3 and g=9.81m/s^2. **[5]**

Q7) a) Draw layout of nuclear power plant and explain the energy extraction with its limitations. **[6]**

b) Explain with neat sketch working of reciprocating pump. **[6]**

OR

Q8) a) Explain working of four stroke petrol engine with neat sketch. **[6]**

b) Explain with neat sketch, single acting single stage reciprocating air compressor. **[6]**

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