

Total No. of Questions—8]

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**[5151]-102**

**F.E. (Common) EXAMINATION, 2017**

**BASIC CIVIL AND ENVIRONMENTAL ENGINEERING**

**(2015 PATTERN)**

**Time : Two Hours**

**Maximum Marks : 50**

- N.B. :—**
- (i) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8.
  - (ii) Figures to the right indicate full marks.
  - (iii) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
  - (iv) Neat diagrams must be drawn wherever necessary.
  - (v) Assume suitable data, if necessary.

1. (a) State precisely the role of civil engineer in the following activities : [4×1=4]
- (i) Planning
  - (ii) Tendering
  - (iii) Construction
  - (iv) Maintenance.
- (b) What is Prestressed Concrete ? State any *two* applications of PSC. [2+2=4]
- (c) State any *four* field applications of Geotechnical Engineering/ Soil Mechanics. [1×4=4]

P.T.O.

*Or*

2. (a) Define Irrigation Engineering. Highlight the importance of irrigation engineering in today's era. [1+3=4]
- (b) Explain with a neat sketch the following : [2+2=4]
- (i) Pile Foundation
- (ii) Uniform settlement.
- (c) Comment on a statement "Use of Recycled materials is the needs of the present era. [4]

3. (a) During a surveying practical on Fly Leveling, following reading were taken with a dumpy level and 4 m Leveling staff. While determining the reduced levels it was found that, some of the reading are missing. [8]
- Calculate the missing reading marked as "X". Also apply the usual Arithmetic Check.

Sr. No.	BS	IS	FS	Rise	Fall	RL	Remarks
1.	×					463.875	TBM1
2.		×		0.550		×	
3.	0.965		3.655		×	×	Change Point 1
4.	×		1.400		×	461.885	Change Point 1
5.			1.025	×		463.875	TBM 1

- (b) How will you stress the importance of sustainable development for developing nations ? [4]

*Or*

4. (a) The following consecutive readings were taken with a level and 4 m leveling staff. Instrument was shifted after third and fifth readings: 1.215, 0.965, 0.685, 2.175, 1.805, 1.745, 0.905, and 2.305. The first reading was taken on a reference point whose RL is known to be 151.235 m. Calculate the Reduced Levels of all Staff stations by the Collimation Plane Method. Apply usual Arithmetic check. [8]

(b) What is E-Waste? What measures should we take to reduce E-waste? [1+3=4]

5. (a) A plot owner has purchased a rectangular plot whose length to breadth ratio is 3.0 and perimeter of the plot is 120 m. He wants to construct a two-storeyed building. As per town planning rules, permissible FSI is 1.00, front margin is 3.0 m and all other margins are 2.5 m. [5]

Calculate :

(i) Ground Coverage

(ii) Area on First Floor.

**Note : Breadth of plots is parallel to road**

(b) Define the following terms : [4]

(i) Set-Back distance

- (ii) Floor Area
  - (iii) F.A.R
  - (iv) Plinth area.
- (c) Differentiate clearly between Aspect and Prospect. [4]

*Or*

6. (a) A plot owner has purchased rectangular plot whose length to breadth ratio is 3.0. and perimeter of the plot is 120 m. He wants to construct two storeyed building. As per town planning rules permissible FSI is 1.00, Front margin is 3.0 m and all other margins are 2.5 m. [5]

Calculate :

- (i) Ground Coverage
- (ii) Area on First Floor.

**Note : Breadth of plots is parallel to road**

- (b) While constructing your own house. What measures will you take to improve the following : [4]
- (i) Circulation
  - (ii) Elegance.
- (c) State with reasons the desirable aspects for the following : [2+2=4]
- (i) Study Room
  - (ii) Sanitary Units.

7. (a) Write a short note on Global Warming. [4]
- (b) Comment on a statement “Efficient use of Renewable sources of Energy will be help us to reduce air pollution in rural area of our country. [5]
- (c) Explain in brief the mechanism of production of Biogas energy. [4]

*Or*

8. (a) Write a short note on Water Pollution. [4]
- (b) Explain in brief the various causes of Land Pollution. [5]
- (c) What measures you will suggest to reduce Land Pollution in Urban ares. [4]

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**[5151]-103**

**F.E. EXAMINATION, 2017  
ENGINEERING GRAPHICS—I  
(2015 PATTERN)**

**Time : Two Hours**

**Maximum Marks : 50**

- N.B. :—** (i) Use only half imperial size drawing sheet as answer-book.  
(ii) Retain all construction lines.  
(iii) Assume suitable data, if necessary.

1. A line PQ 90 mm long, is inclined to H.P and V.P. at  $34^\circ$  and  $30^\circ$  respectively. Draw the projections if point P is 25 mm above H.P. and point Q is 20 mm in front of V.P. Also locate the traces. [12]

*Or*

2. A circular plate of diameter 60 mm is resting on H.P. It is then inclined to H.P. so that the point opposite to resting points is 40 mm above H.P. Draw the projections if the plan of diameter line passing through resting point makes  $35^\circ$  with XY. Find inclinations made by the plate with reference planes. [12]
3. A cone of base diameter 60 mm and axis height 80 mm is resting on H.P. on its base circumferential point. Draw the projections if its axis is inclined at an angle of  $35^\circ$  and  $30^\circ$  with V.P. and H.P. respectively, with apex nearer to observer. [13]

P.T.O.

Or

4. (a) Draw a helix of one revolution to a cylinder of base diameter 60 mm and axis height 120 mm. [7]
- (b) Draw the development of lateral surface of pentagonal prism of base side 30 mm and axis height 60 mm. [6]
5. Figure 1 shows a pictorial view of an object. By using first angle method of projections, draw :
- (i) Front view [4]
- (ii) Sec. right hand side view along the line of symmetry [4]
- (iii) Top view [4]
- (iv) Dimensions. [1]

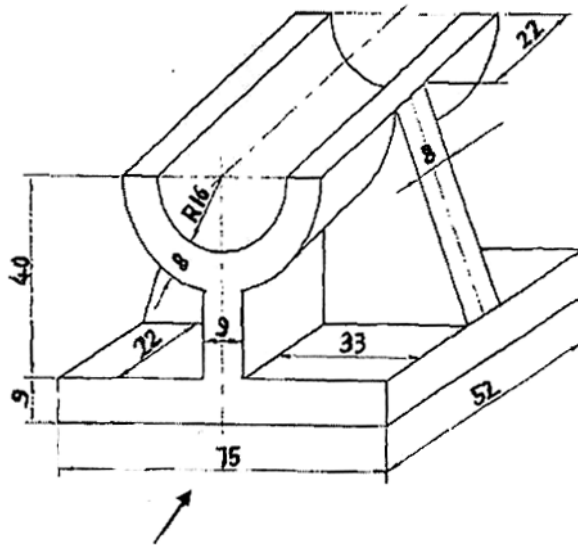


Figure 1

Or

6. Figure 2 shows a pictorial view of an object. By using first angle method of projections, draw :

- (i) Sectional front view, along sectional plane [4]
- (ii) Left hand side view [4]
- (iii) Top view [4]
- (iv) Dimensions. [1]

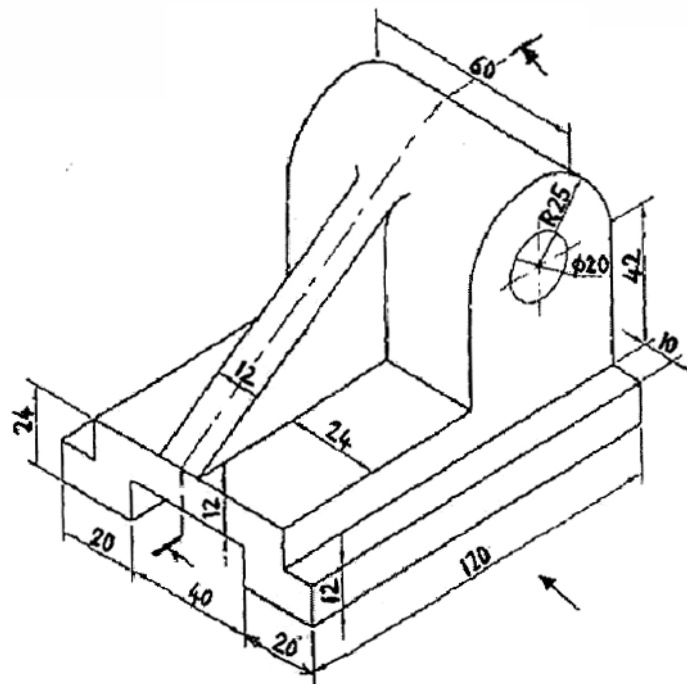


Figure 2



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

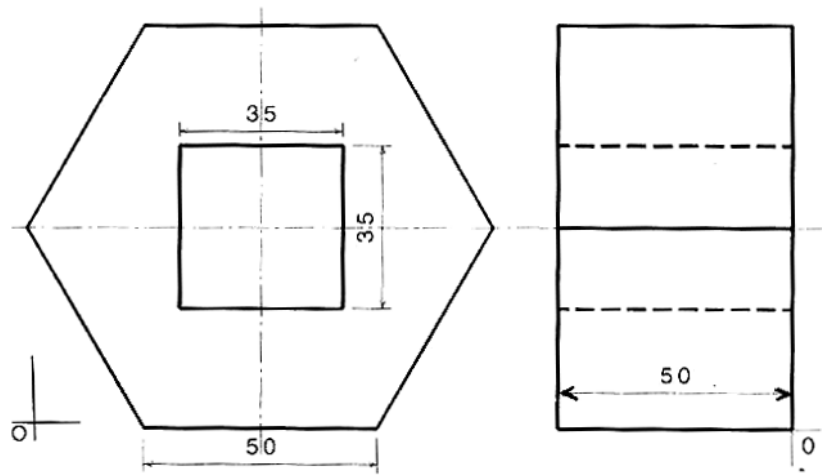


Figure 3

Or

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

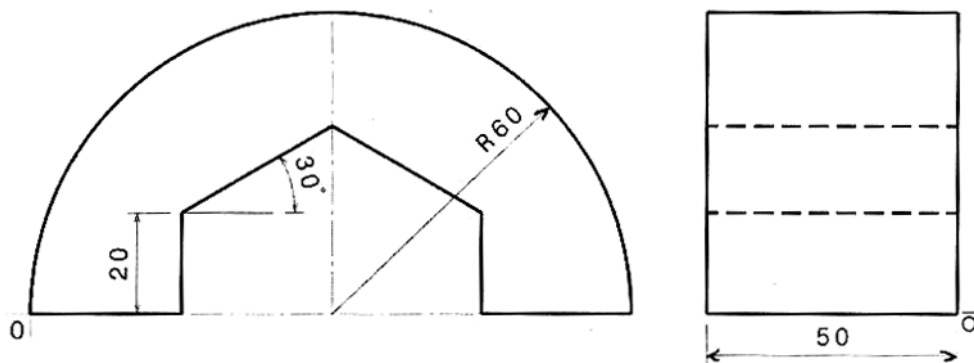


Figure 4

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[5151]-104

F.E. (I Semester) EXAMINATION, 2017

ENGINEERING PHYSICS

(2015 PATTERN)

Time : Two Hours

Maximum Marks : 50

- N.B. :—** (i) Neat diagrams must be drawn wherever necessary.  
(ii) Figures to the right indicate full marks.  
(iii) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.  
(iv) Assume suitable data, if necessary.

- Constants :—**(1) Mass of electron =  $9.1 \times 10^{-31}$  kg.  
(2) Charge on electron,  $e = 1.6 \times 10^{-19}$  C  
(3) Mass of proton,  $M_p = 1.673 \times 10^{-27}$  kg  
(4) Mass of Neutron,  $M_n = 1.675 \times 10^{-27}$  kg  
(5) Planck's constant,  $h = 6.63 \times 10^{-34}$  J.s  
(6) Velocity of light in vacuum,  $c = 3 \times 10^8$  m/s.

1. (a) A thin film of uniform thickness is illuminated by a monochromatic light. Derive an expression for path difference for the reflected rays system. Hence obtain the conditions for constructive and destructive interference. [6]
- (b) What is reverberation time ? Explain any *two* measures to control reverberation time in an auditorium. [3]
- (c) Calculate the reverberation time for an empty hall of volume  $1200 \text{ m}^3$  that has total sound absorption of  $450 \text{ m}^2$  sabine. When the hall is completely occupied, total sound absorption is further increased by  $450 \text{ m}^2$  sabine. Hence calculate the reverberation time. [3]

P.T.O.

*Or*

2. (a) What is piezoelectric effect ? Draw neat and labelled diagram for piezoelectric oscillator and hence explain its construction and working. [6]
- (b) What is diffraction of light ? Differentiate between Fresnel and Fraunhofer diffraction (*two points*). [3]
- (c) A monochromatic light of wavelength  $5500 \text{ \AA}$  incident normally on a slit of width  $2 \times 10^{-4} \text{ cm}$ . Calculate the angular position of first and second minimum. [3]
3. (a) Why is the combination of Helium and Neon gases chosen in He-Ne laser system ? Explain construction and working of He-Ne laser system with the help of energy level diagram. [6]
- (b) Define Fermi level for a semiconductor. Draw a neat and labelled diagram showing position of Fermi level in intrinsic semiconductor and in N-type semiconductor. [3]
- (c) A sample of intrinsic germanium at room temperature has a carrier concentration  $4.41 \times 10^{22} \text{ cm}^{-3}$ . Donor impurity is added in the ratio 1 donor atom per  $10^8$  atoms/ $\text{cm}^3$  of germanium. Determine the resistivity of the material thus formed.  
(Given :  $\mu_e$   $3800 \text{ cm}^2/\text{V.s}$ ) [3]

*Or*

4. (a) What is Hall effect ? Derive the expression for Hall voltage and Hall coefficient. State applications of Hall effect. [6]

- (b) What is double refraction ? Draw neat and labelled diagram (either for positive or negative crystal) showing propagation of light within a doubly refracting crystal when optic axis is : [3]
- (i) parallel to crystal surface  
(ii) perpendicular to crystal surface.
- (c) Sugar solution is kept in a 20 cm long tube. When plane polarized light is passed through this solution, its plane of polarization is rotated by  $10^\circ$ . If the concentration of sugar solution is 0.07575, calculate the specific rotation of sugar. [3]
5. (a) Deduce Schrodinger's time independent wave equation. [6]  
(b) What is de-Broglie hypothesis. Derive an expression for de-Broglie wavelength for an electron when it is accelerated by potential difference 'V'. [4]  
(c) Calculate the energy (in eV) with which a proton has to acquire de-Broglie wavelength of  $0.1\text{\AA}$ . [3]

*Or*

6. (a) State and explain Heisenberg's uncertainty principle. Illustrate the principle by electron diffraction at a single slit. [6]  
(b) Explain physical significance of wave function  $\psi$  and  $(\psi)^2$ . State the mathematical conditions that wave function  $\psi$  should satisfy. [4]  
(c) A neutron is trapped in an infinite potential well of width  $1\text{\AA}$ . Calculate the values of energy and momentum in its ground state. [3]

7. (a) Explain critical magnetic field of superconductor. Differentiate between type-I and type-II superconductors (*four* points). [6]
- (b) With necessary diagram, explain physical method for synthesis of nanoparticles. [4]
- (c) State applications of nano-particles. Explain any *one* application. [3]

*Or*

8. (a) What is nanotechnology ? Explain optical and electrical properties of nano-particles. [6]
- (b) Explain Meissner effect and show that superconductors exhibit perfect diamagnetism. [4]
- (c) State applications of superconductors. Explain any *one* application. [3]

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**[5151]-105**

**F.E. EXAMINATION, 2017**  
**ENGINEERING CHEMISTRY**  
**(2015 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 50**

- N.B. :-** (i) Neat diagrams must be drawn wherever necessary.  
(ii) Figures to the right indicate full marks.  
(iii) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.  
(iv) Assume suitable data, if necessary.

1. (a) What are zeolites ? Explain zeolite process for softening of water. Give regeneration reactions, advantages and disadvantages of the process. [6]
- (b) What is reference electrode ? Draw neat labelled diagram of calomel electrode and give its representation. [3]
- (c) Explain conductometric titration curve for the reaction between KCl and AgNO<sub>3</sub>. [3]

*Or*

2. (a) Explain the pH metric titration of mixture of weak acid-strong acid against standard alkali, giving chemical reactions, procedure, titration curve and calculations. [6]

P.T.O.

- (b) 50 ml of water sample requires 15 ml of 0.02 M EDTA during titration. Whereas 50 ml of boiled water sample requires 11 ml of same EDTA in the titration. Calculate total, temporary and permanent hardness of water sample. [3]
- (c) What are the merits of green synthesis and demerits of traditional synthesis of polycarbonate. [3]
- 3.** (a) What is vulcanisation of rubber ? Explain chemical reaction involved in vulcanisation process. Compare natural rubber with vulcanised rubber. [6]
- (b) Define : [3]
- (i) Octane number
- (ii) Power alcohol
- (iii) Gross calorific value.
- (c) A fuel has the following composition by mass :  
 $e = 83\%$ ,  $H_2 = 12\%$ ,  $S = 1\%$ ,  $O_2 = 3.2\%$  and remaining being ash. Calculate quantity of air. [3]

*Or*

- 4.** (a) What is proximate analysis of coal ? Explain the procedure for determination of each constituent with its formula. [6]
- (b) Distinguish between LDPE and HDPE. [3]
- (c) What is biodegradable polymer ? Give the structure of PHBV and its applications. [3]

5. (a) State the difficulties in storage of hydrogen gas. Give its chemical storage in analates and metal hydrides. [5]
- (b) Give the preparation reaction and applications of germane and lithium hydride. [4]
- (c) Explain the structure and properties of graphite. [4]

*Or*

6. (a) Explain the structure of fullerene. Give any *two* properties and *two* applications of fullerene. [5]
- (b) Explain the production of hydrogen by water splitting using solar energy. [4]
- (c) Explain the isotopes of carbon with their applications. [4]
7. (a) Explain the mechanism of dry corrosion. Discuss the oxidation corrosion in case of Mg, Cr, Mo. [5]
- (b) What is the principle of cathodic protection. Explain it with any *one* suitable method. [4]
- (c) Explain cementation and cladding methods for applying metallic coatings on base metal. [4]



*Or*

- 8.** (a) Define wet corrosion. Explain corrosion by oxygen absorption mechanism. [5]
- (b) What are the factors affecting corrosion ? (Explain nature of metal only) [4]
- (c) Discuss various steps involved in powder coating. [4]

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**[5151]-106**

**F.E. EXAMINATION, 2017**

**BASIC ELECTRICAL ENGINEERING**

**(2015 PATTERN)**

**Time : Two Hours**

**Maximum Marks : 50**

**N.B. :—** (i) Answer Q. 1 or Q. 2, Q. 3 or Q. 4, Q. 5 or Q. 6,  
Q. 7 or Q. 8.

(ii) Neat diagrams must be drawn wherever necessary.

(iii) Figures to right indicate full marks.

(iv) Use of Non-programmable Scientific Calculators is allowed.

(v) Assume suitable data, if necessary

1. (a) State the factors on which resistance of the conductor depends.

What is the effect of increase in temperature on resistance of copper conductor, silicon and nichrome ? [6]

(b) An iron ring has magnetic circuit of cross-section  $10 \text{ cm}^2$  and radial air gap of 1 mm cut in it. The ring is uniformly wound with 1000 turns and current of 2A produces a flux of 1 mWb in the air gap. Calculate the reluctance of magnetic path. [6]

P.T.O.

*Or*

2. (a) Obtain the expression for coefficient of coupling between two magnetically coupled coils. [6]
- (b) An electric motor runs at 600 rpm and produces a torque of 210 N-m. The motor efficiency is 88%. Find motor input power and current drawn when motor is fed at 400 V DC supply. [6]
3. (a) A direct loading test is to be conducted on 1-phase 230/110 V, 2 KVA transformer to determine efficiency and voltage regulation. Draw the neat connection diagram and write down the ranges of the meters used with reasons. [6]
- (b) Obtain the equation for current, when AC voltage  $v = V_m \sin \omega t$  is applied across pure inductance. Draw the circuit diagram, wave form and phasor diagram. [6]

*Or*

4. (a) Sketch curves for charging of capacitor for voltage and current. Write their expressions. Also show the time constant and initial charging current. [6]
- (b) A 10 KVA, 3300/220 V 1-phase 50 Hz transformer has emf per turn equal to 10. Calculate : [6]
- (i) Turns on primary side
  - (ii) Turns on secondary side
  - (iii) Maximum flux in the core
  - (iv) Primary and secondary full load current.

5. (a) Obtain the expression for power, when voltage  $v = V_m \sin \omega t$  is applied across R-C series circuit. [6]
- (b) The resistance of  $5 \Omega$  is connected across 200 V, 50 Hz 1-phase a.c. supply. The voltage across the resistance is 50 V. Calculate : [7]
- (i) voltage across inductance
- (ii) value of inductance
- (iii) power and
- (iv) power factor

Or

6. (a) What is series resonance ? Obtain the expression for resonant frequency. [6]
- (b) Obtain the relation between phase values and line values of voltage and current in case of balanced delta connected 3-ph inductive load. Assume phase sequence RYB. Draw the necessary phasor diagram. [7]
7. (a) State and explain Kirchhoffs laws. [6]
- (b) Find equivalent resistance between A and B for the circuit shown in Fig. 7(b). [7]

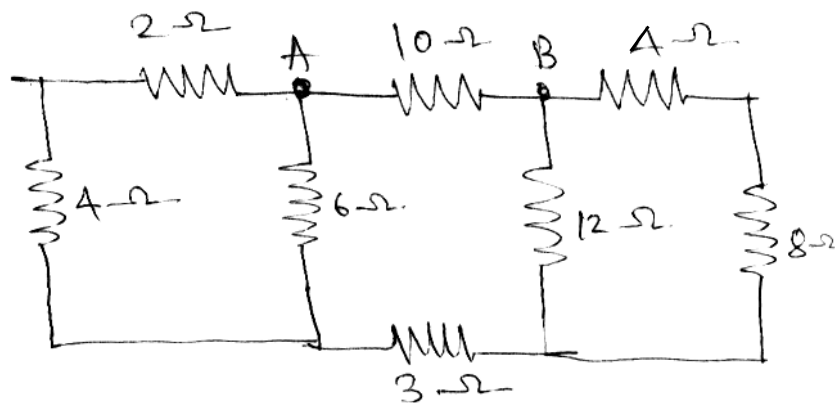


Fig. 7(b)

Or

8. (a) State and explain Superposition theorem. [6]
- (b) Find current flowing through AB using Kirchhoff's laws for the circuit shown in Fig. 8(b) [7]

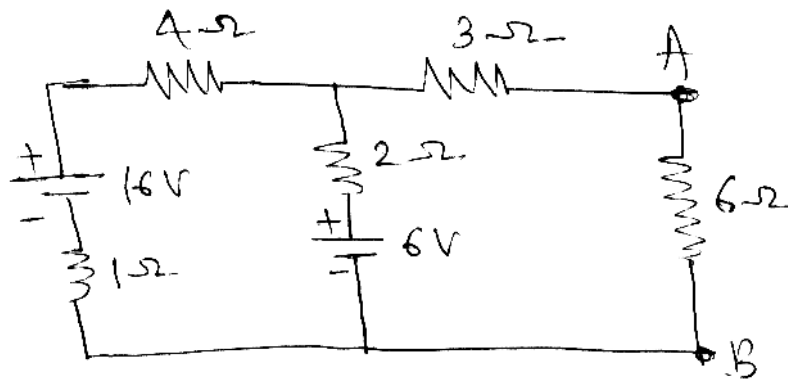


Fig. 8(b)

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**[5151]-107**

**F.E. EXAMINATION, 2017**

**BASIC ELECTRONICS ENGINEERING**

**(2015 PATTERN)**

**Time : Two Hours**

**Maximum Marks : 50**

**N.B. :—** (i) Figures to the right indicate full marks.

(ii) Neat diagrams should be drawn wherever necessary.

(iii) Use of electronic pocket calculator is allowed.

(iv) Assume suitable data, if necessary.

1. (a) Draw the construction diagram and explain working of LED. [6]
- (b) Explain with a neat circuit diagram, function of each component in single stage CE amplifier. [6]

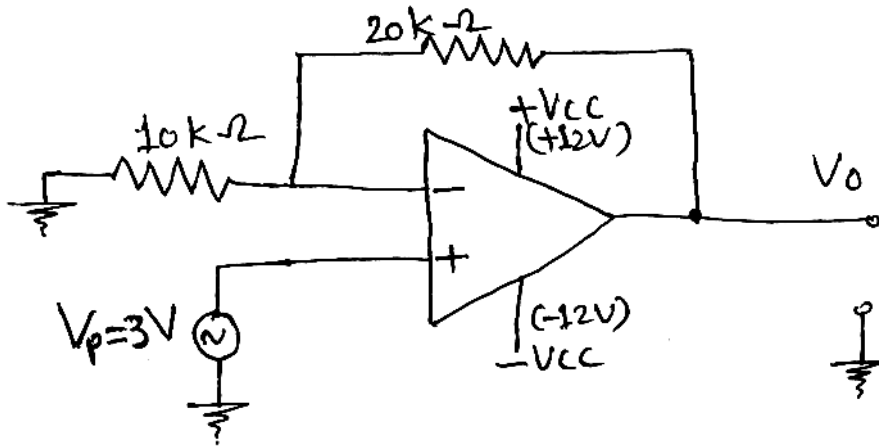
*Or*

2. (a) In a centre tapped FWR, the rms half secondary voltage is 10V. Assuming ideal diodes and load resistance of 2 k $\Omega$ , find : DC load current, ripple factor and efficiency of rectification. [6]
- (b) Draw and explain drain and transfer characteristics of enhancement type P-channel MOSFET. [6]
3. (a) Define Op-Amp. Draw and explain the functional block diagram of an Op-Amp. [6]
- (b) Write law of commutation, law of association and law of distribution for AND and OR logic function. [6]

P.T.O.

Or

4. (a) Calculate output voltage ' $V_o$ ' of Op-Amp circuit shown in figure  
Draw I/P and O/P waveforms. [6]



- (b) Draw and explain the block diagram of microprocessor. [6]
5. (a) Draw construction of DIAC and explain working with V-I characteristics. [6]
- (b) What is electronic weighing machine ? With the help of neat block diagram explain its working. [7]

Or

6. (a) Define transducer. What are the selection criteria for a good transducer ? [7]
- (b) Draw and explain the block diagram of basic instrumentation system. [6]
7. (a) What is electronic communication system ? Explain the elements of communication system with the help of neat block diagram. [7]
- (b) Explain different types of cables used in communication system with neat diagrams. [6]

*Or*

8. (a) Draw neat block diagram of GSM system and explain its working. [6]
- (b) Define modulation index with reference to AM and FM. Write equations of modulation index. Draw AM waveform for 100% modulation case. [7]



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**[5151]-108**

**F.E. EXAMINATION, 2017**  
**ENGINEERING MATHEMATICS-II**  
**(2015 PATTERN)**

**Time : Two Hours**

**Maximum Marks : 50**

- N.B. :—** (i) Attempt *four* questions : Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8.  
(ii) Neat diagrams must be drawn wherever necessary.  
(iii) Figures to the right indicate full marks.  
(iv) Use of electronic non-programmable calculator is allowed.  
(v) Assume suitable data if necessary.

1. (A) Solve the following differential equations : [8]

(i)  $x^4 \frac{dy}{dx} + x^3 y = \sec(xy)$

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

(B) A body starts moving from rest is opposed by a force per unit mass of value  $cx$  and resistance per unit mass of a value  $bv^2$ , where  $x$  and  $v$  are the displacement and velocity of the particle at that instant. Show that the velocity of the particle is given by :

$$v^2 = \frac{c}{2b^2} (1 - e^{-2bx}) - \frac{cx}{b} \quad [4]$$

P.T.O.

Or

2. (A) Solve : [4]

$$\frac{dy}{dx} + x \sin 2y = x^3 \cos^2 y.$$

(B) Solve the following : [8]

(i) Water at temperature 100°C cools in 10-minutes to 88°C in a room of temperature 25°C. Find the temperature of water after 20 minutes.

(ii) A resistance of 100  $\Omega$ , an inductance of 0.5 henry are connected in a series with battery of 20 volts. Find the current in a circuit as a function of time  $t$ .

3. (a) Find Fourier series to represent the function  $f(x) = x$  in  $-\pi < x < \pi$  and  $f(x) = f(x + 2\pi)$ . [5]

(b) Evaluate :

$$\int_0^{\infty} \sqrt{y} \cdot e^{-\sqrt{y}} dy \quad [3]$$

(c) Trace the curve (any one) : [4]

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

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

Or

4. (a) If :

$$I_n = \int_{\pi/4}^{\pi/2} \cot^n \theta d\theta,$$

prove that :

$$I_n = \frac{1}{n-1} - I_{n-2}. \quad [4]$$

(b) Prove that :

$$\int_0^1 \frac{x^a - x^b}{\log x} dx = \log \left( \frac{a+1}{b+1} \right), \quad a > 0, b > 0 \quad [4]$$

(c) Find the length of the arc of cycloid [4]

$x = a (\theta + \sin \theta), y = a (1 - \cos \theta)$   
between two consecutive cusps.

5. (a) Find the centre and radius of the circle which is an intersection of the sphere  $x^2 + y^2 + z^2 - 2y - 4z - 11 = 0$  by the plane  $x + 2y + 2z = 15$ . [5]

(b) Find the equation of the right circular cone which passes through the point (1, 1, 2) & has its axis along the line  $6x = -3y = 4z$  and vertex at (0, 0, 0). [4]

(c) Find the equation of a right circular cylinder of radius 2 whose axis passes through (1, 2, 3) and has direction cosines proportional to 2, -3, 6. [4]

Or

6. (a) Show that the plane  $4x - 3y + 6z - 35 = 0$  is tangential to the sphere  $x^2 + y^2 + z^2 - y - 2z - 14 = 0$ . [5]

(b) Find the equation of a right circular cone whose vertex is at (1, 2, 3) and axis has direction ratios (2, -1, 4) and semivertical angle  $60^\circ$ . [4]

(c) Find the equation of the right circular cylinder of radius 3 whose axis is the line

$$\frac{x-1}{2} = \frac{y-3}{2} = \frac{z-5}{-1}. \quad [4]$$

7. Attempt any *two* of the following :

(a) Evaluate

$$\iint \frac{x^2 y^2 dx dy}{x^2 + y^2}$$

where R is annulus between  $x^2 + y^2 = 4$ ,  $x^2 + y^2 = 9$ . [6]

(b) Evaluate

$$\iiint (x^2 y^2 + y^2 z^2 + z^2 x^2) dx dy dz$$

throughout the volume of sphere  $x^2 + y^2 + z^2 = a^2$ . [7]

(c) Find the moment of inertia of one loop of lemniscate  $r^2 = a^2 \cos 2\theta$  about initial line. [6]

*Or*

8. Attempt any *two* of the following :

(a) Find the total area included between the two cardioids  $r = a (1 + \cos \theta)$  and  $r = a(1 - \cos \theta)$ . [6]

(b) Find the volume cut-off from the paraboloid  $x^2 + \frac{y^2}{4} + z = 1$  by the plane  $z = 0$ . [7]

(c) Find the C.G. of an area of the cardioid :

$$r = a (1 + \cos \theta). \quad [6]$$

Total No. of Questions—6]

[Total No. of Printed Pages—9

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[5151]-109

F.E. (Common) EXAMINATION, 2017

ENGINEERING MECHANICS

(2015 PATTERN)

Time : Two Hours

Maximum Marks : 50

- N.B. :-** (i) Attempt Q. 1 or Q. 2, Q. 3 or Q. 4 and Q. 5 or Q. 6.  
(ii) Neat diagram must be drawn wherever necessary.  
(iii) Figures to the right indicate full marks.  
(iv) Assume suitable data, if necessary and clearly state.  
(v) Use of cell phone is prohibited in the examination hall.  
(vi) Use of electronic pocket calculator is allowed.

1. (a) Determine the magnitude and direction of resultant with reference to point A for the force system as shown in Fig. 1 (a) if side of equilateral triangle is 1 m. [4]

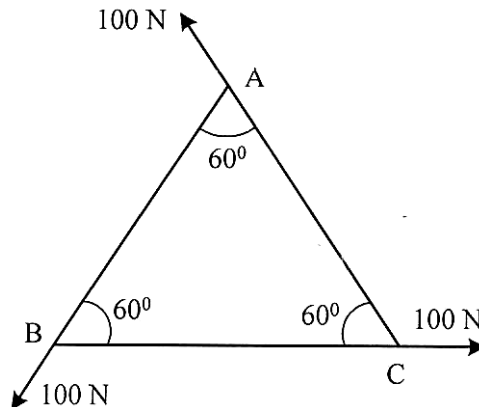
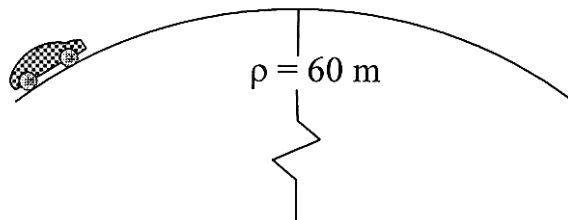


Fig. 1(a)

P.T.O.

- (b) If the crest of the hill has a radius of curvature  $r = 60$  m, determine the maximum constant speed at which the car can travel over it without leaving the surface of the road. The car has a weight of 17.5 kN. Refer Fig. 1 (b). [4]

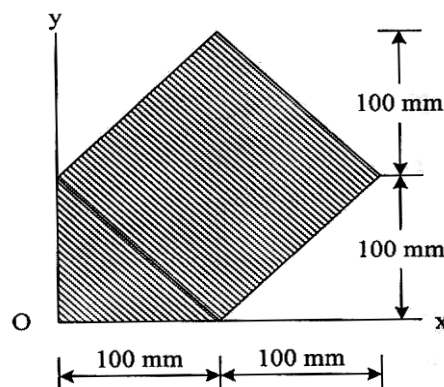


**Fig. 1(b)**

- (c) The acceleration of a particle as it moves along a straight line is given by  $a = (2t - 1)$  m/s<sup>2</sup>, 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 is dropped from a height 1600 mm and it rebounds to a height 1100 mm. Determine the coefficient of restitution. [4]

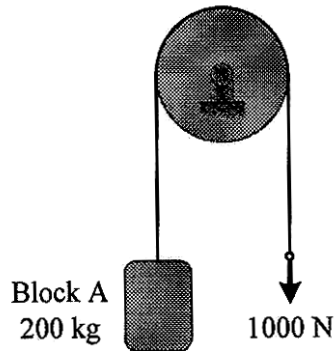
*Or*

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



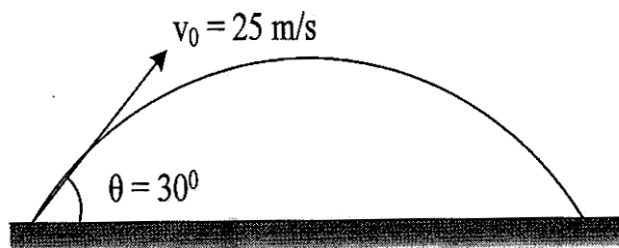
**Fig. 2(a)**

- (b) The system shown in Fig. 2(b) is initially at rest. Neglecting axle friction and mass of pulley, determine the acceleration of block A. [4]



**Fig. 2(b)**

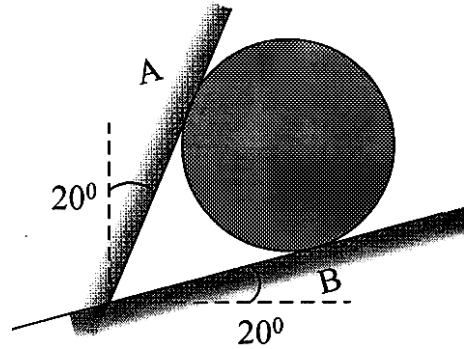
- (c) A projectile is launched with a speed of  $V_0 = 25 \text{ m/s}$  at an angle of  $\theta = 30^\circ$  with horizontal as shown in Fig. 2(c). Determine the maximum distance travelled by projectile along horizontal and vertical direction. [4]



**Fig. 2(c)**

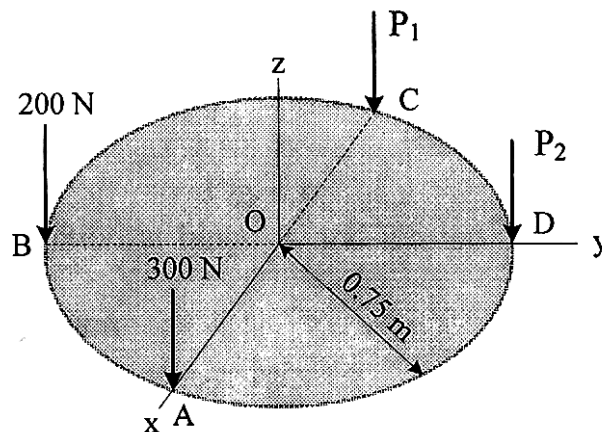
- (d) A ball has a mass of 30 kg is thrown upward with a speed of 15 m/s. Determine the time and distance travelled by the ball before stopping. Use impulse momentum principle. [4]

3. (a) A cylinder of mass 100 kg rest between the inclined plane as shown in Fig. 3(a) Determine the normal reaction at A and B. [6]



**Fig. 3(a)**

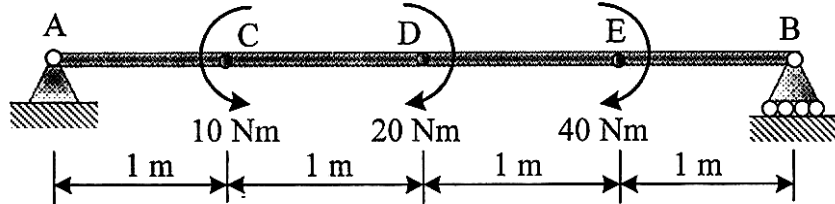
- (b) Four parallel bolting forces act on the rim of the circular cover plate as shown in fig. 3(b). If the resultant force 750 N is passing through (0.15 m, 0.1 m) from the origin O, determine the magnitude of forces  $P_1$  and  $P_2$ . [6]



**Fig. 3(b)**



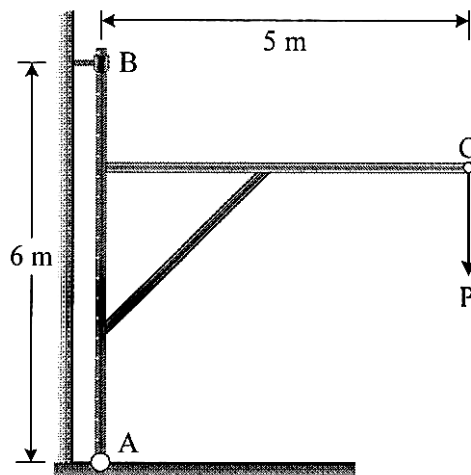
- (c) Determine reaction at A and B for the beam loaded and supported as shown in Fig. 3(c). Moments are act at point C, D and E. [5]



**Fig. 3(c)**

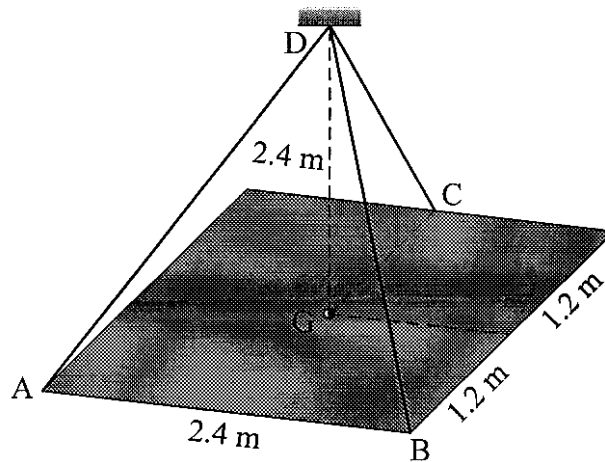
Or

4. (a) The wall crane is supported by smooth collar at B and pin at A as shown in Fig. 4(a). If the vertical component of reaction at A is 10 kN, determine the force P, normal reaction at B and tangential component of reaction at A. [6]



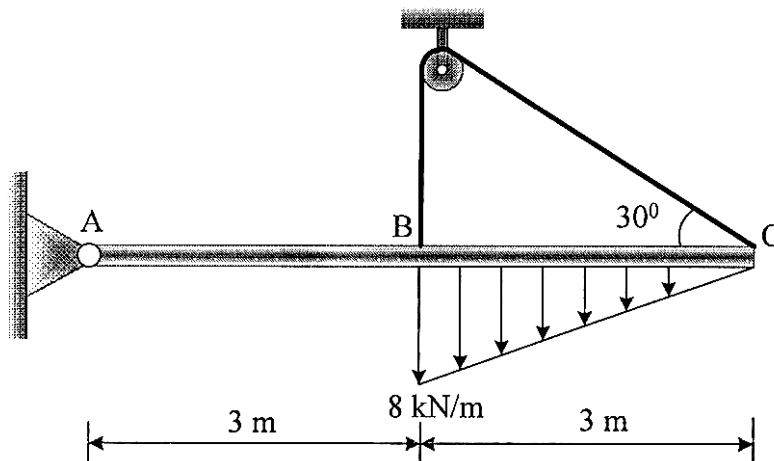
**Fig. 4(a)**

- (b) The square steel plate has a mass of 1800 kg with mass center  $G$  as shown in Fig. 4(b). Determine the tension in each cable so that the plate remains horizontal. [6]



**Fig. 4(b)**

- (c) Determine the component of reaction at hinge A and tension in the cable BC as shown in Fig. 4(c). [5]



**Fig. 4(c)**

5. (a) Determine the distance  $s$  to which the 90 kg painter can climb without causing the 4 m ladder to slip at its lower end A as shown in Fig. 5(a). The top of the 15 kg ladder has a small roller and at the ground the coefficient of static friction  $\mu_s = 0.25$ . The mass center of the painter is directly above its feet. [6]

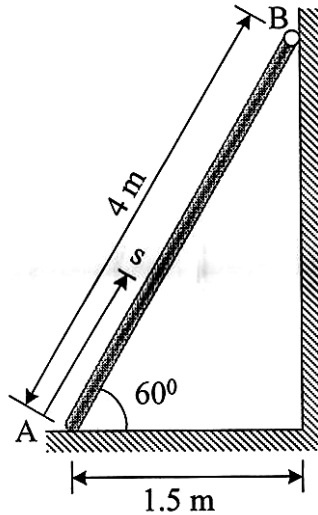


Fig. 5(a)

- (b) Determine support reaction and find the forces in magnitude and direction of the members AD, BD and BC of the simply supported truss as shown in Fig. 5(b) by method of section. Tabulate the result with magnitude and nature of force in the members. [6]

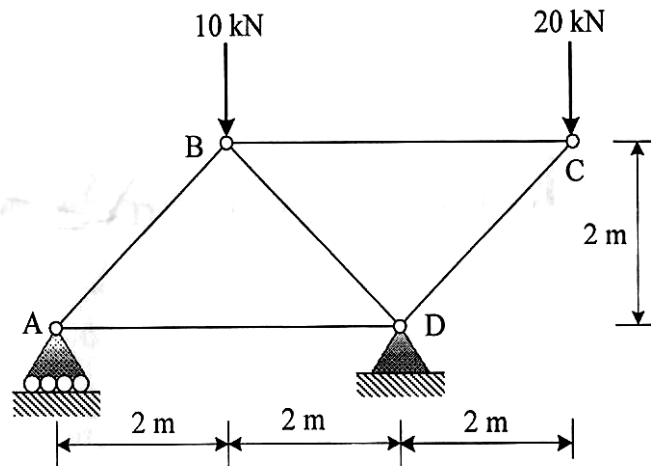
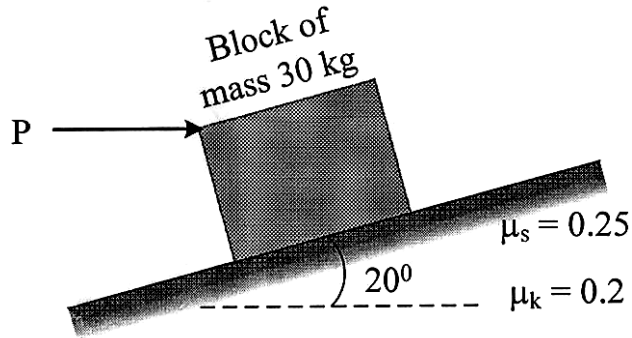


Fig. 5(b)

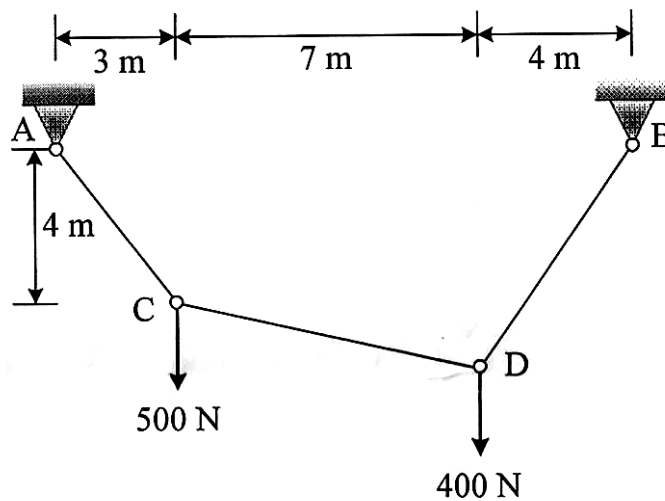
- (c) Determine the horizontal force  $P$  needed to just start moving the 30 kg block up the plane as shown in Fig. 5(c). Take  $\mu_s = 0.25$  and  $\mu_k = 0.2$ . [5]



**Fig. 5(c)**

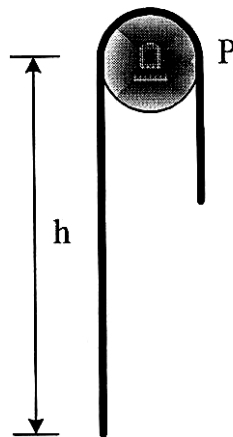
Or

6. (a) The cable segment support the loading as shown in Fig. 6(a). Determine the support reaction and maximum tension in segment of cable. [6]



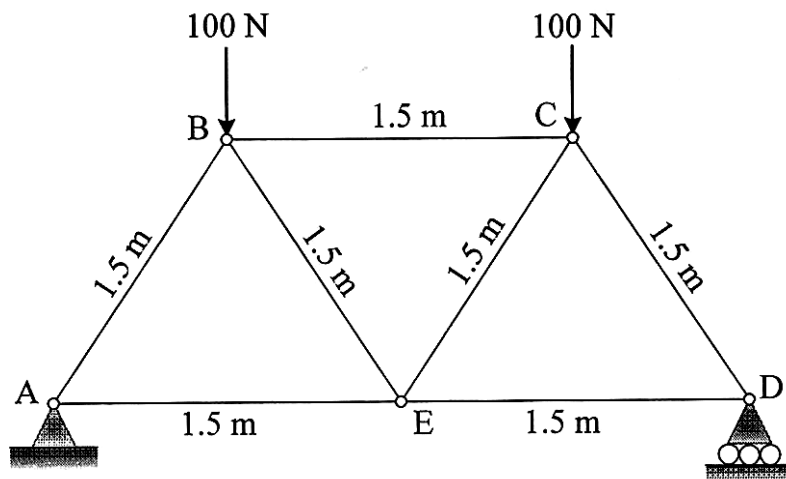
**Fig. 6(a)**

- (b) A chain having a weight of  $1.5 \text{ N/m}$  and a total length of  $10 \text{ m}$  is suspended over a peg  $P$  as shown in Fig. 6(b). If the coefficient of static friction between the peg and cord is  $\mu_s = 0.25$ , determine the largest length  $h$  which one side of the suspended cord can have without causing motion. Neglect the size of peg. [6]



**Fig. 6(b)**

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



**Fig. 6(c)**

Total No. of Questions—8]

[Total No. of Printed Pages—4

<b>Seat No.</b>	
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**[5151]-110**

**F.E. EXAMINATION, 2017**

**BASIC MECHANICAL ENGINEERING**

**(2015 PATTERN)**

**Time : Two Hours**

**Maximum Marks : 50**

- N.B. :—**
- (i) Assume suitable data, if necessary.
  - (ii) Figures to the right indicate full marks.
  - (iii) Neat diagrams must be drawn wherever necessary.
  - (iv) Use of non-programmable electronic calculator is permitted.
  - (v) Attempt *four* questions out of eight Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8.

1. (a) Draw neat diagrams of : [6]
- (i) Ball bearing and
  - (ii) Disc brake.
- (b) Define the following mechanical properties of material : [6]  
Strength, Toughness, Hardness, Creep, Plasticity and Elasticity.

P.T.O.

*Or*

- 2.** (a) Draw sketches of V belt drive, chain drive and spur gear drive. [6]
- (b) Compare mechanism and machine (*four* points). Draw a schematic sketch of reciprocating compressor. [6]
- 3.** (a) What is sand casting process ? Draw neat sketch of sand casting process setup and explain steps involved in the process. [7]
- (b) Draw a block diagram of a radial drilling machine and explain tapping operation with sketch. [6]

*Or*

- 4.** (a) Draw neat sketch of soldering process setup. Explain the process in brief. State application of the process. [6]
- (b) Draw a block diagram of lathe machine. Explain function of headstock, tailstock and carriage. [7]
- 5.** (a) State any *two* statements and limitations of first law of thermodynamics. [4]
- (b) Draw schematic sketches of : [4]
- (i) Barometer
  - (ii) U-Tube Manometer
  - (iii) Thermocouple
  - (iv) Isolated system.

- (c) A fish freezing plant is to be maintained at  $-10$  degree C. If power required to drive the plant is 30 kW and COP of refrigeration system is 3. Find : [5]
- (i) heat sucked (absorbed) from the freezing plant and
  - (ii) heat rejected to the surrounding.
- Draw sketch of the system.

*Or*

6. (a) Explain the following : [4]
- (i) System, surrounding and boundary
  - (ii) Kelvin Plank's statement of second law of thermodynamics.
- (b) Draw sketches of heat pump and refrigerator system. Derive the relation between COP of Heat Pump and COP of Refrigerator. [4]
- (c) The pressure of kerosene flowing through a pipe is to be measured with simple U-tube mercury manometer. Left arm of U-tube is connected to pipe while right arm of the U-tube is open to atmosphere.
- Calculate the absolute pressure of the kerosene in pipeline and mercury level in right-arm above datum when kerosene level in left arm is 60 cm above datum. Draw the sketch of the setup.

Given :

Atmospheric Pressure = 10 m of water column



Gauge Pressure of kerosene = 22 kPa

Acceleration due to gravity,  $g = 9.81 \text{ m/s}^2$

Specific gravity of the kerosene = 0.8

Density of mercury =  $13600 \text{ kg/m}^3$ . [5]

7. (a) Draw a sketch of wind power plant. Explain energy transfer (extraction) in the power plant and state its limitations. [6]
- (b) Draw neat sketch of four stroke cycle spark ignition engine. Compare two stroke and four stroke cycle engines. (*Four Imp Points*). [6]

*Or*

8. (a) Draw a sketch of hydro-electric power plant. Explain energy transfer (extraction) in the power plant and state its limitations. [6]
- (b) Explain construction and working of centrifugal pump. [6]